EPO - DG 2 COPY
22. 08. 2014
51

Claims

We claim:

1. A method of predicting whether a cancer patient is likely to benefit from administration of a yeast-based immune response generating therapy for cancer, either alone or in addition to another anti-cancer therapy, comprising the steps of:

(a) obtaining a blood-derived sample of the patient;

(b) conducting mass-spectrometry on the sample and obtaining a mass spectrum from the sample;

(c) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients and classifying the mass spectrum with a class label indicating the status of benefit or non-benefit;

wherein the class label predicts whether the patient is likely to benefit from the yeast-based immune response generating therapy, either alone or in addition to other anti-cancer therapies.

2. The method of claim 1, wherein the yeast-based immunotherapy comprises a yeast-based immunotherapy for mutated Ras-positive cancer.

3. The method of claim 3, wherein the yeast-based immunotherapy for mutated Ras-positive cancer comprises GI-4000 or the equivalent.

4. The method of claim 3, wherein the yeast-based immunotherapy for mutated Ras-positive cancer therapy is administered to the patient in conjunction with gemcitabine or the equivalent.

5. The method of claim 1, wherein the cancer patient comprises a pancreatic cancer patient.

6. The method of claim 2, wherein the cancer patient comprises a pancreatic cancer patient.

7. The method of claim 1, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast-based immune response generating therapy or immunotherapy either alone or in combination with another anti-cancer therapy.

8. The method of claim 1, wherein the selected features include one or more features listed in Tables 1, 2, 3, 4, 5, or 6.

9. A method of predicting whether a cancer patient is not likely to benefit from administration of a yeast-based immune response generating therapy, either alone or in combination with another anti-cancer therapy, comprising the steps of:

(a) obtaining a blood-derived sample of the patient;

(b) conducting mass-spectrometry on the sample and obtaining a mass spectrum from the sample;

(c) in a programmed computer, performing one or more predefined pre-processing

steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients and classifying the mass spectrum with a class label indicating the status of benefit or non-benefit;

wherein the class label predicts whether the patient is not likely to benefit from the yeast-based immune response generating therapy either alone or in addition to another anti-cancer therapy.

10. The method of claim 9, wherein the yeast-based immunotherapy for cancer comprises a yeast-based immunotherapy for mutated Ras-positive cancer.

11. The method of claim 10, wherein the yeast-based immunotherapy for mutated Ras-positive cancer comprises GI-4000 or the equivalent.

12. The method of claim 10, wherein the patient is predicted to not likely benefit from administration of the yeast-based immunotherapy for mutated Ras-positive cancer therapy in conjunction with gemcitabine or the equivalent.

13. The method of claim 9, wherein the cancer patient comprises a pancreatic cancer patient.

14. The method of claim 9, wherein the training set comprises class-labeled spectra from other cancer patients that obtained benefit and did not obtain benefit from administration of the immunotherapy either alone or in combination with another anti-cancer therapy.

15. The method of claim 9, wherein the selected features comprise one or more features listed in Tables 1, 2, 3, 4, 5 or 6.

16. A system for predicting whether a cancer patient is likely to benefit from administration of a yeast-based immune response generating therapy either alone or in combination with another anti-cancer therapy, comprising, in combination:

a mass spectrometer generating a mass spectrum from a blood-derived sample from the cancer patient;

a machine readable memory storing a training set of class-labeled spectra from other cancer patients, the training set including class-labeled spectra from plurality of patients that did not benefit from the yeast-based immune response generating either alone or in combination with the another anti-cancer therapy and class-labeled spectra from plurality of patients that did benefit from the immune response generating therapy either alone or in combination with the another anti-cancer agent; and

a computer system configured to operate on the mass spectrum and classify the mass spectrum using the training set, producing a class label for the mass spectrum indicating the status of benefit or non-benefit, wherein the class label predicts whether the patient is likely to benefit from administration of the yeast-based immune response generating therapy either alone or in combination with another anti-cancer agent.

17. The system of claim 16, wherein the class label predicts whether the patient is likely to benefit from administration of a yeast-based immunotherapy for mutated Ras-positive cancer.

18. The system of claim 16, wherein the yeast-based immunotherapy for mutated Ras-positive cancers comprises GI-4000 or the equivalent.

19. The system of claim 16, wherein the class label predicts whether patient is likely to benefit from administration of GI-4000 and gemcitabine to the patient.

20. The system of claim 16, wherein the cancer patient comprises a pancreatic cancer patient.

21. The system of claim 16, wherein the computer is configured to obtain integrated intensity values of features in the spectrum in m/z ranges which include one or more of the features listed in Tables 1, 2, 3, 4, 5 or 6.

22. A system for predicting whether a cancer patient is not likely to obtain benefit from administration of a yeast-based immune response generating therapy either alone or in combination with another anti-cancer therapy, comprising, in combination:

a mass spectrometer generating a mass spectrum from a blood-derived sample from the cancer patient;

a machine readable memory storing a training set of class-labeled spectra from other cancer patients, the training set including class-labeled spectra from plurality of patients that did not benefit from the immune response generating therapy either alone or in combination with the another anti-cancer therapy and class-labeled spectra from plurality of patients that did benefit from the immune response generating therapy either alone or in combination with the another anti-cancer agent; and

a computer system configured to operate on the mass spectrum and classify the mass

spectrum using the training set, producing a class label for the mass spectrum indicating the status of benefit or non-benefit, wherein the class label predicts whether the patient is not likely to obtain benefit from a yeast-based immunotherapy either alone or in combination with another anti-cancer agent.

23. The system of claim 22, wherein the yeast-based immunotherapy for cancer comprises a yeast-based immunotherapy for mutated Ras-positive cancer.

24. The system of claim 23, wherein the yeast-based immunotherapy for mutated Ras-positive cancer comprises GI-4000 or the equivalent.

25. The system of claim 24, wherein the class label predicts whether the patient is not likely to benefit from administration of GI-4000 and gemcitabine.

26. The system of claim 24, wherein the cancer patient comprises a pancreatic cancer patient.

27. The system of claim 22, wherein the computer is configured to obtain integrated intensity values of features in the spectrum in m/z ranges which include one or more of the features listed in Table 1, 2, 3, 4 5 or 6.

28. The method of claim 1, wherein the step of conducting mass spectrometry on the sample comprises conducting MALDI TOF mass spectrometry.

29. The method of claim 28, wherein the MALDI-TOF mass spectrometry comprises

conducting DeepMALDI mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

30. The method of claim 1, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of blood-derived samples of cancer patients , each of the mass spectra obtained by DeepMALDI mass spectrometry in which the blood-derived samples are subject to more than 20,000 laser shots.

31. The system of claim 16, wherein the mass spectrometer comprises a MALDI-TOF mass spectrometer configured to obtain spectra by subjecting the blood-derived sample to more than 20,000 laser shots.

32. A composition comprising a computer executing a classification algorithm combined with a non-transitory computer readable medium storing data in the form of a training set for a classifier comprising class-labeled mass spectra from a plurality of cancer patients, including class-labeled mass spectra from plurality of cancer patients that did not benefit from a yeast-based immune response generating therapy either alone or in combination with the another anti-cancer therapy and class-labeled mass spectra from a plurality of cancer patients that did benefit from the yeast-based immune response generating therapy either alone or in combination with the another anti-cancer therapy, the class label indicating the status of benefit or non-benefit.

33. The composition of claim 32, wherein the non-transitory computer readable medium stores data in the form of a training set for a classifier comprising class-labeled mass spectra from a plurality of cancer patients, including class-labeled mass spectra from plurality of

cancer patients that did not benefit from yeast-based immunotherapy for mutated Ras-positive cancer either alone or in conjunction with the another anti-cancer therapy and class-labeled mass spectra from plurality of cancer patients that did benefit from the yeast-based immunotherapy for mutated Ras-positive cancer either alone or in conjunction with the another anti-cancer therapy, the class label indicating the status of benefit or non-benefit.

34. The composition of claim 33, wherein the class labels indicate whether the patients in the training set benefitted, or did not benefit, from administration of the combination of GI-4000 and gemcitabine.

35. The composition of claim 32, wherein the cancer patients in the training set comprise pancreatic cancer patients.

36. The composition of claim 32, wherein the medium stores code in the form of a classifier for comparing features in the training set including one or more of features listed in Tables 1, 2, 3 or 4 with a test mass spectrum to thereby produce a class label for the test mass spectrum.

37. A system for classifying a mass spectrum comprising:

a non-transitory computer-readable medium as recited in claim 32 and

a general purpose computer configured as a classifier to classify a spectrum of a cancer patient using the training set of claim 32.

38. The system of claim 37, wherein the computer implements a K nearest neighbor classifier.

39. A method of creating a classifier for predicting, in advance of treatment, whether a cancer patient is likely to benefit from a yeast-based immune response generating therapy, either alone or in combination with another anti-cancer therapy, comprising the steps of:

a) performing mass spectrometry on a multitude of patient samples obtained after treatment by the yeast-based immune response generating therapy either alone or in combination with another anti-cancer therapy and generating a corresponding set of mass spectra;

b) creating a training set for a classifier by separating the patients from which the samples in step a) were obtained into two groups corresponding to whether or not such patients obtained benefit from the treatment and assigning a class label indicating the status of benefit or non-benefit to the respective spectra;

c) analyzing the spectra from the two groups to identify distinguishing features in the spectra characteristic of the patients in the two groups; and

d) testing the ability of such distinguishing features to predict patient benefit from the treatment by applying a classification algorithm using the class labeled spectra and distinguishing features identified in step c) to a test set of spectra from other patients that were administered the treatment and evaluating the performance of the classification algorithm.

40. The method of claim 39, comprising repeating the steps b), c) and d) using different distinguishing features in the spectra in the two groups of patients.

41. The method of claim 39, wherein the classification algorithm comprises a K-nearest neighbor algorithm.

42. The method of claim 39, wherein the mass spectrometry of step a) comprises DeepMALDI mass spectrometry in a MALDI-TOF mass spectrometer in which the sample is subject to more than 20,000 laser shots.

43. The method of claim 39, wherein the distinguishing features comprise one or more features listed in Tables 1, 2, 3, 4, 5 or 6.

44. The method of claim 39, further comprising performing a partial ion current normalization of the spectra based on features in the spectra in the training set.

45. The method of claim 39, wherein the class labels are determined by investigation of clinical data for the patients in the training set.

46. A method for treating a cancer, comprising administering yeast-based immunotherapy for cancer to a cancer patient,

wherein the patient has been selected by a mass spectrometry and classification test, the test comprising the steps of:

(a) conducting mass-spectrometry on a blood-derived sample from the patient and obtaining a mass spectrum from the sample;

(b) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients treated with the yeast-based immunotherapy and classifying the

mass spectrum with a class label indicating the status of benefit or non-benefit;

and wherein the class label for the mass spectrum indicates that the patient is likely to benefit from the yeast-based immunotherapy for cancer.

47. The method of claim 46, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for cancer.

48. The method of claim 47, wherein the additional anti-cancer therapies are selected from: surgery, chemotherapy, radiation therapy, targeted cancer therapy, palliative care, or any combination thereof.

49. The method of claim 46, wherein the yeast-based immunotherapy is a whole, heat-inactivated recombinant yeast that has expressed one or more cancer antigens from the patient's cancer.

50. The method of claim 49, wherein the yeast is from *Saccharomyces cerevisiae*.

51. The method of claim 46, wherein the patient has mutated Ras-positive cancer and wherein the patient is administered a yeast-based immunotherapy for mutated Ras-positive cancer

52. The method of claim 51, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for mutated Ras-positive cancer.

53. The method of claim 52, wherein the additional anti-cancer therapies are selected from: surgery, chemotherapy, radiation therapy, targeted cancer therapy, palliative care, or any combination thereof.

54. The method of claim 51, wherein the mutated Ras-positive cancer is selected from: pancreas cancer, non-small cell lung cancer (NSCLC), colorectal cancer (CRC), endometrial cancers, ovarian cancers, melanoma or multiple myeloma.

55. The method of claim 51, wherein the mutated Ras-positive cancer is pancreas cancer.

56. The method of claim 51, wherein the yeast-based immunotherapy for mutated Ras-positive cancer is a whole, heat-inactivated recombinant yeast that has expressed a mutated Ras antigen.

57. The method of claim 55, wherein the yeast-based immunotherapy for mutated Ras-positive cancer is a product in the GI-4000 series of yeast-based immunotherapy products, or the equivalent.

58. The method of claim 57, wherein the product is selected from GI-4014, GI-4015, GI-4016 or GI-4020.

59. The method of claim 51, wherein the yeast-based immunotherapy is administered in conjunction with gemcitabine or the equivalent.

60. The method of claim 51, wherein the cancer patient's tumor has been surgically resected prior to treatment with the yeast-based immunotherapy.

61. The method of claim 49, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast-based immunotherapy either alone or in combination with another anti-cancer therapy.

62. The method of claim 49, wherein the predefined features include one or more features listed in Tables 1, 2, 3, 4, 5 or 6.

63. The method of claim 49, wherein the mass spectrometry conducted on the sample comprises conducting MALDI-TOF mass spectrometry.

64. The method of claim 63, wherein the MALDI-TOF mass spectrometry comprises conducting DeepMALDI mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

65. The method of claim 49, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of cancer patients obtained by DeepMALDI mass spectrometry in which blood-derived samples of such cancer patients are subject to more than 20,000 laser shots.

66. A method for treating a cancer with yeast-based immunotherapy, comprising:

a) conducting mass-spectrometry on a blood-derived sample from a cancer patient and obtaining a mass spectrum from the sample;

b) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients treated with the yeast-based immunotherapy and classifying the mass spectrum with a class label indicating the status of benefit or non-benefit; and

c) administering the yeast-based immunotherapy for cancer to the cancer patient when the class label for the mass spectrum indicates that the patient is likely to benefit from the yeast-based immunotherapy for cancer.

67. The method of claim 66, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the

yeast-based immunotherapy for cancer.

68. The method of claim 66, wherein the yeast-based immunotherapy is a whole, heat-inactivated recombinant yeast from *Saccharomyces cerevisiae* that has expressed one or more cancer antigens from the patient's cancer.

69. The method of claim 66, wherein the patient has mutated Ras-positive cancer and wherein the patient is administered a yeast-based immunotherapy for mutated Ras-positive cancer.

70. The method of claim 69, wherein the product is selected from GI-4014, GI-4015, GI-4016 or GI-4020.

71. The method of claim 66, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast based immunotherapy either alone or in combination with another anti-cancer therapy.

72. The method of claim 66, wherein the predefined features include one or more features listed in Tables 1, 2, 3, 4, 5 or 6.

73. The method of claim 66, wherein the mass spectrometry conducted on the sample comprises conducting MALDI-TOF mass spectrometry.

74. The method of claim 73, wherein the MALDI-TOF mass spectrometry comprises conducting multi-shot mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

75. The method of claim 66, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of cancer patients obtained by multi-shot mass spectrometry in which blood-derived samples of such cancer patients are subject to more than 20,000 laser shots.

We claim:

1. A method of predicting whether a cancer patient is likely to benefit from administration of a yeast-based immune response generating therapy for cancer, either alone or in addition to another anti-cancer therapy, comprising the steps of:

(a) obtaining a blood-derived sample of the patient;

(b) conducting mass-spectrometry on the sample and obtaining a mass spectrum from the sample;

(c) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients and classifying the mass spectrum with a class label;

wherein the class label predicts whether the patient is likely to benefit from the yeast-based immune response generating therapy, either alone or in addition to other anti-cancer therapies.

2. The method of claim 1, wherein the yeast-based immunotherapy comprises a yeast-based immunotherapy for mutated Ras-positive cancer.

3. The method of claim 3, wherein the yeast-based immunotherapy for mutated Ras-positive cancer comprises GI-4000 or the equivalent.

4. The method of claim 3, wherein the yeast-based immunotherapy for mutated Ras-positive cancer therapy is administered to the patient in conjunction with gemcitabine or the equivalent.

5. The method of claim 1, wherein the cancer patient comprises a pancreatic cancer patient.

6. The method of claim 2, wherein the cancer patient comprises a pancreatic cancer patient.

7. The method of claim 1, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast-based immune response generating therapy or immunotherapy either alone or in combination with another anti-cancer therapy.

8. The method of claim 1, wherein the selected features include one or more features listed below in Tables 1, 2, 3, 4, 5, or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |

| | | | |
|---|---|---|---|
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |

| | | | |
|---|---|---|---|
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |

| | | | |
|---|---|---|---|
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |

| | | | |
|---|---|---|---|
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |

| | | | |
|---|---|---|---|
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |

| | | | | | |
|---|---|---|---|---|---|
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

9. A method of predicting whether a cancer patient is not likely to benefit from administration of a yeast-based immune response generating therapy, either alone or in combination with another anti-cancer therapy, comprising the steps of:

(a) obtaining a blood-derived sample of the patient;

(b) conducting mass-spectrometry on the sample and obtaining a mass spectrum from the sample;

(c) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients and classifying the mass spectrum with a class label;

wherein the class label predicts whether the patient is not likely to benefit from the yeast-based immune response generating therapy either alone or in addition to another anti-cancer therapy.

10. The method of claim 9, wherein the yeast-based immunotherapy for cancer comprises a yeast-based immunotherapy for mutated Ras-positive cancer.

11. The method of claim 10, wherein the yeast-based immunotherapy for mutated Ras-positive cancer comprises GI-4000 or the equivalent.

12. The method of claim 10, wherein the patient is predicted to not likely benefit from administration of the yeast-based immunotherapy for mutated Ras-positive cancer therapy in conjunction with gemcitabine or the equivalent.

13. The method of claim 9, wherein the cancer patient comprises a pancreatic cancer patient.

14. The method of claim 9, wherein the training set comprises class-labeled spectra from other cancer patients that obtained benefit and did not obtain benefit from administration of the immunotherapy either alone or in combination with another anti-cancer therapy.

15. The method of claim 9, wherein the selected features comprise one or more features listed below in Tables 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |

| | | | |
|---|---|---|---|
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |

| | | | |
|---|---|---|---|
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |

| | | | |
|---|---|---|---|
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |

| | | | |
|---|---|---|---|
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |

| | | | |
|---|---|---|---|
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

16. A system for predicting whether a cancer patient is likely to benefit from administration of a yeast-based immune response generating therapy either alone or in combination with another anti-cancer therapy, comprising, in combination:

a mass spectrometer generating a mass spectrum from a blood-derived sample from the cancer patient;

a machine readable memory storing a training set of class-labeled spectra from other cancer patients, the training set including class-labeled spectra from plurality of patients that did not benefit from the yeast-based immune response generating either alone or in combination with the another anti-cancer therapy and class-labeled spectra from plurality of patients that did benefit from the immune response generating therapy either alone or in combination with the another anti-cancer agent; and

a computer system configured to operate on the mass spectrum and classify the mass spectrum using the training set, producing a class label for the mass spectrum, wherein the class label predicts whether the patient is likely to benefit from administration of the yeast-based immune response generating therapy either alone or in combination with another anti-cancer agent.

17. The system of claim 16, wherein the class label predicts whether the patient is likely to benefit from administration of a yeast-based immunotherapy for mutated Ras-positive cancer.

18. The system of claim 16, wherein the yeast-based immunotherapy for mutated Ras-positive cancers comprises GI-4000 or the equivalent.

19. The system of claim 16, wherein the class label predicts whether patient is likely to benefit from administration of GI-4000 and gemcitabine to the patient.

20. The system of claim 16, wherein the cancer patient comprises a pancreatic cancer patient.

21. The system of claim 16, wherein the computer is configured to obtain integrated intensity values of features in the spectrum in m/z ranges which include one or more of the features listed below in Tables 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |

| | | | |
|---|---|---|---|
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |

| | | | |
|---|---|---|---|
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |

| | | | |
|---|---|---|---|
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |

| | | | |
|---|---|---|---|
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |

| | | | |
|---|---|---|---|
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

22. A system for predicting whether a cancer patient is not likely to obtain benefit from administration of a yeast-based immune response generating therapy either alone or in combination with another anti-cancer therapy, comprising, in combination:

a mass spectrometer generating a mass spectrum from a blood-derived sample from the cancer patient;

a machine readable memory storing a training set of class-labeled spectra from other cancer patients, the training set including class-labeled spectra from plurality of patients that did not benefit from the immune response generating therapy either alone or in combination with the another anti-cancer therapy and class-labeled spectra from plurality of patients that did benefit from the immune response generating therapy either alone or in combination with the another anti-cancer agent; and

a computer system configured to operate on the mass spectrum and classify the mass spectrum using the training set, producing a class label for the mass spectrum, wherein the class label predicts whether the patient is not likely to obtain benefit from a yeast-based immunotherapy either alone or in combination with another anti-cancer agent.

23. The system of claim 22, wherein the yeast-based immunotherapy for cancer comprises a yeast-based immunotherapy for mutated Ras-positive cancer.

24. The system of claim 23, wherein the yeast-based immunotherapy for mutated Ras-positive cancer comprises GI-4000 or the equivalent.

25. The system of claim 24, wherein the class label predicts whether the patient is not likely to benefit from administration of GI-4000 and gemcitabine.

26. The system of claim 24, wherein the cancer patient comprises a pancreatic cancer patient.

27. The system of claim 22, wherein the computer is configured to obtain integrated intensity values of features in the spectrum in m/z ranges which include one or more of the features listed below in Table 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |

| | | |
|---|---|---|
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |

| | | | |
|---|---|---|---|
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|

| |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |

| | | | |
|---|---|---|---|
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |

| | | | |
|---|---|---|---|
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 | Subset of 32 | Subset of 25 | Subset of 13 | Subset of 22 | Eight features |
|---|---|---|---|---|---|

| features from Tables 3, 4, 5 and additional features K=3 | features from Table 5 K=3 | features from Tables 3, 4, 5 and additional features K=5 | features from Tables 3, 4, 5 and additional features K=5 | features (no features from Table 3) K=7 | (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |

| | | | | | |
|---|---|---|---|---|---|
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

28. The method of claim 1, wherein the step of conducting mass spectrometry on the sample comprises conducting MALDI TOF mass spectrometry.

29. The method of claim 28, wherein the MALDI-TOF mass spectrometry comprises conducting DeepMALDI mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

30. The method of claim 1, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of blood-derived samples of cancer patients , each of the mass spectra obtained by DeepMALDI mass spectrometry in which the blood-derived samples are subject to more than 20,000 laser shots.

31. The system of claim 16, wherein the mass spectrometer comprises a MALDI-TOF mass spectrometer configured to obtain spectra by subjecting the blood-derived sample to more than 20,000 laser shots.

32. A non-transitory computer readable medium storing data in the form of a training set for a classifier comprising class-labeled mass spectra from a plurality of cancer patients, including class-labeled mass spectra from plurality of cancer patients that did not benefit from a yeast-based immune response generating therapy either alone or in combination with the another anti-cancer therapy and class-labeled mass spectra from a plurality of cancer patients that did benefit from the yeast-based immune response generating therapy either alone or in combination with the another anti-cancer therapy, the class label indicating the status of benefit or non-benefit.

33. The non-transitory computer readable medium of claim 32, wherein the medium stores data in the form of a training set for a classifier comprising class-labeled mass spectra from a plurality of cancer patients, including class-labeled mass spectra from plurality of cancer patients that did not benefit from yeast-based immunotherapy for mutated Ras-positive cancer either alone or in conjunction with the another anti-cancer therapy and class-labeled mass spectra from plurality of cancer patients that did benefit from the yeast-based immunotherapy for mutated Ras-positive cancer either alone or in conjunction with the another anti-cancer therapy, the class label indicating the status of benefit or non-benefit.

34. The medium of claim 33, wherein the class labels indicate whether the patients in the training set benefitted, or did not benefit, from administration of the combination of GI-4000 and gemcitabine.

35. The medium of claim 32, wherein the cancer patients in the training set comprise pancreatic cancer patients.

36. The medium of claim 32, wherein the medium stores code in the form of a classifier for comparing features in the training set including one or more of features listed below in Tables 1, 2, 3 or 4 with a test mass spectrum to thereby produce a class label for the test mass spectrum:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |

| | | | |
|---|---|---|---|
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |

| | | | |
|---|---|---|---|
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

37. A system for classifying a mass spectrum comprising:

a non-transitory computer-readable as recited in claim 32 and

a general purpose computer configured as a classifier to classify a spectrum of a cancer patient using the training set of claim 32.

38. The system of claim 37, wherein the computer implements a K nearest neighbor classifier.

39. A method of creating a classifier for predicting, in advance of treatment, whether a cancer patient is likely to benefit from a yeast-based immune response generating therapy, either alone or in combination with another anti-cancer therapy, comprising the steps of:

a) performing mass spectrometry on a multitude of patient samples obtained after treatment by the yeast-based immune response generating therapy either alone or in combination with another anti-cancer therapy and generating a corresponding set of mass spectra;

b) creating a training set for a classifier by separating the patients from which the samples in step a) were obtained into two groups corresponding to whether or not such patients obtained benefit from the treatment and assigning a class label to the respective spectra (e.g., "good"/ "poor", "Quick"/ "Slow");

c) analyzing the spectra from the two groups to identify distinguishing features in the spectra characteristic of the patients in the two groups; and

d) testing the ability of such distinguishing features to predict patient benefit from the treatment by applying a classification algorithm using the class labeled spectra and distinguishing features identified in step c) to a test set of spectra from other patients that were administered the treatment and evaluating the performance of the classification algorithm.

40. The method of claim 39, comprising repeating the steps b), c) and d) using different distinguishing features in the spectra in the two groups of patients.

41. The method of claim 39, wherein the classification algorithm comprises a K-nearest neighbor algorithm.

42. The method of claim 39, wherein the mass spectrometry of step a) comprises DeepMALDI mass spectrometry in a MALDI-TOF mass spectrometer in which the sample is subject to more than 20,000 laser shots.

43. The method of claim 39, wherein the distinguishing features comprise one or more features listed below in Tables 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|

| | | |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |

| | | | |
|---|---|---|---|
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |

| | | | |
|---|---|---|---|
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |

| | | | |
|---|---|---|---|
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |

| | | | |
|---|---|---|---|
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |

| | | | |
|---|---|---|---|
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

44. The method of claim 39, further comprising performing a partial ion current normalization of the spectra based on features in the spectra in the training set.

45. The method of claim 39, wherein the class labels are determined by investigation of clinical data for the patients in the training set.

46. A method of selecting a cancer patient to be treated with yeast-based immunotherapy,

wherein the patient is to be selected by a mass spectrometry and classification test, the test comprising the steps of:

(a) conducting mass-spectrometry on a blood-derived sample from the patient and obtaining a mass spectrum from the sample;

(b) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients treated with the yeast-based immunotherapy and classifying the mass spectrum with a class label;

and wherein the class label for the mass spectrum indicates that the patient is likely to benefit from the yeast-based immunotherapy for cancer.

47. The method of claim 46, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for cancer.

48. The method of claim 47, wherein the additional anti-cancer therapies are selected from: surgery, chemotherapy, radiation therapy, targeted cancer therapy, palliative care, or any combination thereof.

49. The method of claim 46, wherein the yeast-based immunotherapy is a whole, heat-inactivated recombinant yeast that has expressed one or more cancer antigens from the patient's cancer.

50. The method of claim 49, wherein the yeast is from *Saccharomyces cerevisiae*.

51. The method of claim 46, wherein the patient has mutated Ras-positive cancer and wherein the patient is administered a yeast-based immunotherapy for mutated Ras-positive cancer.

52. The method of claim 51, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for mutated Ras-positive cancer.

53. The method of claim 52, wherein the additional anti-cancer therapies are selected from: surgery, chemotherapy, radiation therapy, targeted cancer therapy, palliative care, or any combination thereof.

54. The method of claim 51, wherein the mutated Ras-positive cancer is selected from: pancreas cancer, non-small cell lung cancer (NSCLC), colorectal cancer (CRC), endometrial cancers, ovarian cancers, melanoma or multiple myeloma.

55. The method of claim 51, wherein the mutated Ras-positive cancer is pancreas cancer.

56. The method of claim 51, wherein the yeast-based immunotherapy for mutated Ras-positive cancer is a whole, heat-inactivated recombinant yeast that has expressed a mutated Ras antigen.

57. The method of claim 55, wherein the yeast-based immunotherapy for mutated Ras-positive cancer is a product in the GI-4000 series of yeast-based immunotherapy products, or the equivalent.

58. The method of claim 57, wherein the product is selected from GI-4014, GI-4015, GI-4016 or GI-4020.

59. The method of claim 51, wherein the yeast-based immunotherapy is administered in conjunction with gemcitabine or the equivalent.

60. The method of claim 51, wherein the cancer patient's tumor has been surgically resected prior to treatment with the yeast-based immunotherapy.

61. The method of claim 49, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast-based immunotherapy either alone or in combination with another anti-cancer therapy.

62. The method of claim 46, wherein the predefined features include one or more features listed below in Tables 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |

| | | | |
|---|---|---|---|
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |

| | | | |
|---|---|---|---|
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |

| | | | |
|---|---|---|---|
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |

| | | | |
|---|---|---|---|
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |

| | | | |
|---|---|---|---|
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

63. The method of claim 49, wherein the mass spectrometry conducted on the sample comprises conducting MALDI-TOF mass spectrometry.

64. The method of claim 63, wherein the MALDI-TOF mass spectrometry comprises conducting DeepMALDI mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

65. The method of claim 49, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of cancer patients obtained by DeepMALDI mass spectrometry in which blood-derived samples of such cancer patients are subject to more than 20,000 laser shots.

66. A method of making a decision on whether to treat a cancer patient with yeast-based immunotherapy, comprising:

a) conducting mass-spectrometry on a blood-derived sample from a cancer patient and obtaining a mass spectrum from the sample;

b) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients treated with the yeast-based immunotherapy and classifying the mass spectrum with a class label; and

c) basing a decision to administer the yeast-based immunotherapy for cancer to the cancer patient when the class label for the mass spectrum indicates that the patient is likely to benefit from the yeast-based immunotherapy for cancer.

67. The method of claim 66, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for cancer.

68. The method of claim 66, wherein the yeast-based immunotherapy is a whole, heat-inactivated recombinant yeast from *Saccharomyces cerevisiae* that has expressed one or more cancer antigens from the patient's cancer.

69. The method of claim 66, wherein the patient has mutated Ras-positive cancer and wherein the patient is administered a yeast-based immunotherapy for mutated Ras-positive cancer.

70. The method of claim 69, wherein the product is selected from GI-4014, GI-4015, GI-4016 or GI-4020.

71. The method of claim 66, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast based immunotherapy either alone or in combination with another anti-cancer therapy.

72. The method of claim 66, wherein the predefined features include one or more features listed below in Tables 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |

| | | | |
|---|---|---|---|
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |

| | | | |
|---|---|---|---|
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |

| | | | |
|---|---|---|---|
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |

| | | | |
|---|---|---|---|
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |

| | | | | | |
|---|---|---|---|---|---|
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |

| | | | | | |
|---|---|---|---|---|---|
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

.

73. The method of claim 66, wherein the mass spectrometry conducted on the sample comprises conducting MALDI-TOF mass spectrometry.

74. The method of claim 73, wherein the MALDI-TOF mass spectrometry comprises conducting multi-shot mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

75. The method of claim 66, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of cancer patients obtained by multi-shot mass spectrometry in which blood-derived samples of such cancer patients are subject to more than 20,000 laser shots.

76. Use of yeast-based immunotherapy in the preparation of a medicament for the treatment of cancer in a cancer patient who has been selected for treatment by a mass spectrometry and classification test, the test comprising the steps of:

(a) conducting mass-spectrometry on a blood-derived sample from the patient and obtaining a mass spectrum from the sample;

(b) in a programmed computer, performing one or more predefined pre-processing steps on the mass spectrum, obtaining integrated intensity values of selected features in the mass spectrum over predefined m/z ranges after the pre-processing steps are performed, and

comparing the integrated intensity values with a training set comprising class-labeled spectra from other cancer patients treated with the yeast-based immunotherapy and classifying the mass spectrum with a class label;

and wherein the class label for the mass spectrum indicates that the patient is likely to benefit from the yeast-based immunotherapy for cancer.

77. The use of claim 76, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for cancer.

78. The use of claim 77, wherein the additional anti-cancer therapies are selected from: surgery, chemotherapy, radiation therapy, targeted cancer therapy, palliative care, or any combination thereof.

79. The use of claim 76, wherein the yeast-based immunotherapy is a whole, heat-inactivated recombinant yeast that has expressed one or more cancer antigens from the patient's cancer.

80. The use of claim 79, wherein the yeast is from *Saccharomyces cerevisiae.*

81. The use of claim 76, wherein the patient has mutated Ras-positive cancer and wherein the yeast-based immunotherapy is a yeast-based immunotherapy for mutated Ras-positive cancer.

82. The use of claim 81, wherein the patient is additionally treated with one or more additional anti-cancer therapies, either prior to, concurrently with, or after, treatment with the yeast-based immunotherapy for mutated Ras-positive cancer.

83. The use of claim 82, wherein the additional anti-cancer therapies are selected from: surgery, chemotherapy, radiation therapy, targeted cancer therapy, palliative care, or any combination thereof.

84. The use of claim 81, wherein the mutated Ras-positive cancer is selected from: pancreas cancer, non-small cell lung cancer (NSCLC), colorectal cancer (CRC), endometrial cancers, ovarian cancers, melanoma or multiple myeloma.

85. The use of claim 81, wherein the mutated Ras-positive cancer is pancreas cancer.

86. The use of claim 81, wherein the yeast-based immunotherapy for mutated Ras-positive cancer is a whole, heat-inactivated recombinant yeast that has expressed a mutated Ras antigen.

87. The use of claim 85, wherein the yeast-based immunotherapy for mutated Ras-positive cancer is a product in the GI-4000 series of yeast-based immunotherapy products, or the equivalent.

88. The use of claim 87, wherein the product is selected from GI-4014, GI-4015, GI-4016 or GI-4020.

89. The use of claim 81, wherein the yeast-based immunotherapy is administered in conjunction with gemcitabine or the equivalent.

90. The use of claim 81, wherein the cancer patient's tumor has been surgically resected prior to use of the yeast-based immunotherapy.

91. The use of claim 76, wherein the training set comprises class-labeled spectra from other cancer patients who obtained benefit and did not obtain benefit from administration of the yeast-based immunotherapy either alone or in combination with another anti-cancer therapy.

92. The method of claim 76, wherein the predefined features include one or more features listed below in Tables 1, 2, 3, 4, 5 or 6:

Table 1

| m/Z center of feature | m/Z left edge of feature | m/Z right edge of feature |
|---|---|---|
| 5841.168 | 5831.035 | 5851.302 |
| 6433.537 | 6427.831 | 6439.244 |
| 8765.432 | 8757.666 | 8773.197 |

| | | |
|---|---|---|
| 9669.883 | 9618.946 | 9720.82 |
| 11442.47 | 11428.45 | 11456.49 |
| 11474.93 | 11460.88 | 11488.99 |
| 11529.59 | 11518.95 | 11540.22 |
| 11696.79 | 11650.43 | 11743.15 |
| 11900.24 | 11878.99 | 11921.49 |
| 12865.48 | 12856.36 | 12874.6 |

Table 2

| Peak # | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3039.529 | 3037.053 | 3042.005 |
| 2 | 3366.615 | 3358.219 | 3375.011 |
| 3 | 3432.149 | 3412.777 | 3451.52 |
| 4 | 3473.153 | 3453.337 | 3492.969 |
| 5 | 3552.474 | 3543.957 | 3560.992 |
| 6 | 3680.091 | 3672.995 | 3687.187 |
| 7 | 3842.836 | 3836.58 | 3849.092 |
| 8 | 4203.838 | 4193.707 | 4213.969 |
| 9 | 5180.126 | 5176.524 | 5183.728 |
| 10 | 5291.206 | 5287.73 | 5294.682 |
| 11 | 5700.687 | 5689.381 | 5711.994 |
| 12 | 5843.129 | 5840 | 5846.258 |
| 13 | 5860.729 | 5851.114 | 5870.344 |
| 14 | 5866.576 | 5862.227 | 5870.926 |
| 15 | 6008.828 | 6004.271 | 6013.384 |
| 16 | 6192.594 | 6182.541 | 6202.648 |
| 17 | 6298.994 | 6294.655 | 6303.333 |
| 18 | 6873.363 | 6870.128 | 6876.598 |
| 19 | 6903.79 | 6894.561 | 6913.018 |
| 20 | 6971.019 | 6967.629 | 6974.408 |
| 21 | 6985.879 | 6982.461 | 6989.296 |
| 22 | 6995.012 | 6991.486 | 6998.538 |
| 23 | 7009.091 | 7002.267 | 7015.914 |
| 24 | 7023.426 | 7019.431 | 7027.422 |
| 25 | 7035.244 | 7031.664 | 7038.825 |
| 26 | 7045.484 | 7041.962 | 7049.005 |
| 27 | 7057.527 | 7050.655 | 7064.399 |
| 28 | 7074.719 | 7070.399 | 7079.039 |
| 29 | 7150.539 | 7136.65 | 7164.429 |
| 30 | 7245.544 | 7237.996 | 7253.093 |
| 31 | 7301.145 | 7297.011 | 7305.279 |
| 32 | 7783.506 | 7778.087 | 7788.925 |
| 33 | 8361.169 | 8355.605 | 8366.734 |

| | | | |
|---|---|---|---|
| 34 | 8476.978 | 8470.468 | 8483.489 |
| 35 | 8767.557 | 8761.746 | 8773.368 |
| 36 | 9362.525 | 9353.951 | 9371.098 |
| 37 | 9671.94 | 9664.199 | 9679.681 |
| 38 | 9759.032 | 9751.081 | 9766.982 |
| 39 | 9788.134 | 9772.707 | 9803.561 |
| 40 | 9871.152 | 9861.387 | 9880.918 |
| 41 | 11302.64 | 11295.53 | 11309.76 |
| 42 | 10485.61 | 10471.48 | 10499.73 |
| 43 | 10776.72 | 10762.23 | 10791.21 |
| 44 | 11475.86 | 11468.27 | 11483.45 |
| 45 | 11494.79 | 11487.31 | 11502.27 |
| 46 | 11529.86 | 11522.63 | 11537.1 |
| 47 | 11555.31 | 11541.01 | 11569.61 |
| 48 | 11655.18 | 11616.93 | 11693.44 |
| 49 | 11709.95 | 11701.41 | 11718.49 |
| 50 | 11761.94 | 11724.72 | 11799.16 |
| 51 | 11858.02 | 11814.24 | 11901.79 |
| 52 | 11909.8 | 11902.01 | 11917.58 |
| 53 | 11939.01 | 11929.83 | 11948.2 |
| 54 | 12348.32 | 12339.42 | 12357.22 |
| 55 | 12866.6 | 12858.57 | 12874.62 |
| 56 | 13072.62 | 13064.42 | 13080.81 |
| 57 | 13090.91 | 13082.14 | 13099.68 |
| 58 | 13360.65 | 13351.7 | 13369.59 |
| 59 | 13807.33 | 13786.47 | 13828.18 |
| 60 | 13913.92 | 13897.53 | 13930.32 |
| 61 | 14043.98 | 14035.87 | 14052.09 |
| 62 | 14092.28 | 14084.11 | 14100.46 |
| 63 | 14125.28 | 14117.13 | 14133.43 |
| 64 | 14148.15 | 14139.99 | 14156.32 |
| 65 | 14197.84 | 14181.99 | 14213.69 |
| 66 | 14258.28 | 14249.88 | 14266.69 |
| 67 | 14429.84 | 14414.32 | 14445.35 |
| 68 | 14384.69 | 14357.6 | 14411.78 |
| 69 | 14530.4 | 14520.1 | 14540.7 |
| 70 | 18801.94 | 18784.71 | 18819.18 |
| 71 | 18861.88 | 18844.22 | 18879.55 |
| 72 | 18904.03 | 18884.67 | 18923.4 |
| 73 | 19860.06 | 19771.09 | 19949.03 |
| 74 | 21710.89 | 21683.49 | 21738.29 |
| 75 | 22998.95 | 22839.61 | 23158.29 |
| 76 | 28314 | 28282.63 | 28345.37 |

| | | | |
|---|---|---|---|
| 77 | 28518.76 | 28486.77 | 28550.75 |

Table 3

| m/z ranges |
|---|
| 5732 to 5795 |
| 5811 to 5875 |
| 6398 to 6469 |
| 11376 to 11515 |
| 11459 to 11599 |
| 11614 to 11756 |
| 11687 to 11831 |
| 11830 to 11976 |
| 12375 to 12529 |
| 12502 to 12656 |
| 23183 to 23525 |
| 23279 to 23622 |
| 65902 to 67502 |

Table 4

| Peak Number | m/z |
|---|---|
| 1 | 5843 |
| 2 | 11445 |
| 3 | 11529 |
| 4 | 11685 |
| 5 | 11759 |
| 6 | 11903 |
| 7 | 12452 |
| 8 | 12579 |

Table 5.

| | m/z center | m/z left edge | m/z right edge |
|---|---|---|---|
| 1 | 3463.350 | 3459.400 | 3467.300 |
| 2 | 3609.960 | 3605.630 | 3614.280 |
| 3 | 3679.430 | 3674.080 | 3684.770 |
| 4 | 3840.800 | 3834.810 | 3846.780 |
| 5 | 3892.750 | 3889.050 | 3896.440 |
| 6 | 4077.700 | 4072.100 | 4083.300 |
| 7 | 4492.020 | 4485.400 | 4498.640 |
| 8 | 4597.040 | 4592.710 | 4601.370 |
| 9 | 5405.660 | 5400.820 | 5410.500 |
| 10 | 5555.430 | 5549.440 | 5561.410 |
| 11 | 5582.800 | 5578.980 | 5586.620 |
| 12 | 5635.590 | 5631.640 | 5639.530 |
| 13 | 5706.610 | 5701.520 | 5711.700 |
| 14 | 5762.000 | 5758.050 | 5765.940 |
| 15 | 5840.660 | 5836.580 | 5844.730 |

| | | | |
|---|---|---|---|
| 16 | 5873.770 | 5870.200 | 5877.330 |
| 17 | 5890.570 | 5885.730 | 5895.410 |
| 18 | 6107.260 | 6102.290 | 6112.220 |
| 19 | 6129.670 | 6125.720 | 6133.610 |
| 20 | 6328.570 | 6323.730 | 6333.410 |
| 21 | 6892.580 | 6888.250 | 6896.900 |
| 22 | 6951.990 | 6948.040 | 6955.930 |
| 23 | 6981.660 | 6977.580 | 6985.730 |
| 24 | 7004.170 | 6999.330 | 7009.000 |
| 25 | 7054.210 | 7048.220 | 7060.190 |
| 26 | 7153.620 | 7148.910 | 7158.330 |
| 27 | 7295.310 | 7289.320 | 7301.290 |
| 28 | 7421.920 | 7417.970 | 7425.870 |
| 29 | 8357.210 | 8351.730 | 8362.680 |
| 30 | 8762.290 | 8756.430 | 8768.140 |
| 31 | 8992.440 | 8987.350 | 8997.530 |
| 32 | 9199.780 | 9193.160 | 9206.400 |
| 33 | 9794.720 | 9791.280 | 9798.160 |
| 34 | 10000.020 | 9993.530 | 10006.510 |
| 35 | 10018.610 | 10013.260 | 10023.960 |
| 36 | 10090.630 | 10083.880 | 10097.370 |
| 37 | 10174.760 | 10168.520 | 10181.000 |
| 38 | 10200.610 | 10191.950 | 10209.270 |
| 39 | 10657.440 | 10651.960 | 10662.910 |
| 40 | 10713.840 | 10704.160 | 10723.510 |
| 41 | 10912.750 | 10905.490 | 10920.000 |
| 42 | 11402.140 | 11396.410 | 11407.870 |
| 43 | 11432.410 | 11425.280 | 11439.540 |
| 44 | 11466.160 | 11459.660 | 11472.650 |
| 45 | 11488.190 | 11481.820 | 11494.550 |
| 46 | 11520.580 | 11514.720 | 11526.430 |
| 47 | 11543.880 | 11538.400 | 11549.350 |
| 48 | 11563.080 | 11556.070 | 11570.080 |
| 49 | 11620.250 | 11613.120 | 11627.380 |
| 50 | 11676.220 | 11670.870 | 11681.570 |
| 51 | 11699.260 | 11694.040 | 11704.480 |
| 52 | 11723.200 | 11716.450 | 11729.950 |
| 53 | 11744.210 | 11739.370 | 11749.050 |
| 54 | 11775.740 | 11767.330 | 11784.140 |
| 55 | 11821.600 | 11814.600 | 11828.600 |
| 56 | 11839.680 | 11833.950 | 11845.410 |

| | | | |
|---|---|---|---|
| 57 | 11882.560 | 11877.850 | 11887.270 |
| 58 | 11900.770 | 11894.660 | 11906.880 |
| 59 | 12401.800 | 12392.760 | 12410.840 |
| 60 | 12975.740 | 12968.730 | 12982.740 |
| 61 | 13104.010 | 13098.150 | 13109.860 |
| 62 | 13145.130 | 13138.380 | 13151.880 |
| 63 | 13399.430 | 13388.090 | 13410.760 |
| 64 | 13475.490 | 13468.100 | 13482.870 |
| 65 | 13622.780 | 13616.670 | 13628.890 |
| 66 | 13648.070 | 13642.590 | 13653.540 |
| 67 | 13677.100 | 13670.860 | 13683.340 |
| 68 | 13735.490 | 13731.670 | 13739.310 |
| 69 | 13781.970 | 13774.960 | 13788.970 |
| 70 | 13800.220 | 13794.870 | 13805.570 |
| 71 | 14007.100 | 14002.010 | 14012.190 |
| 72 | 14030.530 | 14023.400 | 14037.660 |
| 73 | 14057.140 | 14051.410 | 14062.870 |
| 74 | 14078.920 | 14073.060 | 14084.770 |
| 75 | 14096.180 | 14091.340 | 14101.020 |
| 76 | 14112.220 | 14107.890 | 14116.550 |
| 77 | 14137.690 | 14129.540 | 14145.840 |
| 78 | 14186.020 | 14178.130 | 14193.910 |
| 79 | 14244.340 | 14232.110 | 14256.560 |
| 80 | 14280.730 | 14272.960 | 14288.490 |
| 81 | 14408.640 | 14403.290 | 14413.980 |
| 82 | 14423.030 | 14418.310 | 14427.740 |
| 83 | 14436.400 | 14431.050 | 14441.740 |
| 84 | 14518.120 | 14508.310 | 14527.920 |
| 85 | 14537.850 | 14531.740 | 14543.960 |
| 86 | 14653.490 | 14645.820 | 14661.150 |
| 87 | 14715.700 | 14706.780 | 14724.610 |
| 88 | 15618.160 | 15597.660 | 15638.660 |
| 89 | 17443.590 | 17430.700 | 17456.470 |
| 90 | 18734.930 | 18724.840 | 18745.010 |
| 91 | 21675.550 | 21649.880 | 21701.220 |
| 92 | 22987.930 | 22971.630 | 23004.220 |
| 93 | 23020.930 | 23009.110 | 23032.740 |
| 94 | 28038.090 | 27994.740 | 28081.430 |
| 95 | 28231.950 | 28203.250 | 28260.650 |
| 96 | 28438.910 | 28393.220 | 28484.590 |
| 97 | 28804.560 | 28750.090 | 28859.030 |

Table 6

| Subset of 42 features from Tables 3, 4, 5 and additional features K=3 | Subset of 32 features from Table 5 K=3 | Subset of 25 features from Tables 3, 4, 5 and additional features K=5 | Subset of 13 features from Tables 3, 4, 5 and additional features K=5 | Subset of 22 features (no features from Table 3) K=7 | Eight features (4 not used in the other classifiers) K=3 |
|---|---|---|---|---|---|
| | 4492 | | | 4492 | |
| | | | | | 5636 |
| | 5762 | | | | |
| 5841 | 5841 | | | | |
| | | | | | 5891 |
| | 6893 | 6893 | | 6893 | |
| | 7004 | | | 7004 | |
| 7295 | | 7295 | | | |
| 7422 | 7422 | | | 7422 | |
| 8357 | | 8357 | | | 8357 |
| | 8762 | 8762 | 8762 | 8762 | |
| | 8992 | | | 8992 | |
| 9795 | | | | | 9795 |
| 10000 | | 10000 | | | |
| | 10175 | | | 10175 | |
| 11402 | | | | | |
| 11432 | | | | | |
| 11466 | 11466 | 11466 | 11466 | | 11466 |
| 11488 | | | | | |
| 11521 | 11521 | 11521 | 11521 | | |
| 11544 | | | | | |
| 11563 | | | | | |
| 11620 | 11620 | 11620 | 11620 | | |
| 11676 | 11676 | | | | |
| 11699 | 11699 | | | | |
| 11723 | 11723 | 11723 | | | |
| 11744 | | | | | |
| 11776 | | | | | |
| | | | | | 11822 |
| 11883 | 11883 | | | | |
| 11901 | | | | | |
| | 12976 | | | | |
| | | | | | 13104 |

| | | | | | |
|---|---|---|---|---|---|
| 13145 | | 13145 | | | |
| 13623 | | 13623 | | | |
| 13648 | 13648 | 13648 | 13648 | 13648 | 13648 |
| | 13677 | | | 13677 | |
| 13735 | 13735 | 13735 | 13735 | 13735 | |
| 13782 | 13782 | 13782 | 13782 | 13782 | |
| | 14007 | | | 14007 | |
| 14057 | 14057 | 14057 | 14057 | 14057 | |
| 14096 | | 14096 | | | |
| 14112 | | 14112 | | | |
| 14138 | | 14138 | | | |
| 14244 | | 14244 | | | |
| 14281 | | 14281 | | | |
| 14423 | 14423 | 14423 | 14423 | 14423 | |
| 14436 | 14436 | | | 14436 | |
| 14538 | 14538 | 14538 | 14538 | 14538 | |
| | 14716 | | | 14716 | |
| 17444 | | | | | |
| 18735 | | | | | |
| 22988 | 22988 | 22988 | 22988 | 22988 | |
| 23021 | | | | | |
| 28038 | 28038 | 28038 | 28038 | 28038 | |
| 28232 | 28232 | 28232 | 28232 | 28232 | |
| | 28439 | | | 28439 | |
| 28805 | 28805 | | | 28805 | |

93. The use of claim 76, wherein the mass spectrometry conducted on the sample comprises conducting MALDI-TOF mass spectrometry.

94. The use of claim 93, wherein the MALDI-TOF mass spectrometry comprises conducting DeepMALDI mass spectrometry in which the blood-derived sample is subject to more than 20,000 laser shots.

95. The use of claim 76, wherein the predefined m/z regions are obtained from investigation of a plurality of mass spectra of cancer patients obtained by DeepMALDI mass spectrometry in which blood-derived samples of such cancer patients are subject to more than 20,000 laser shots.