

CLAIMS

1. A computing system comprising:
at least one processor;
a non-transitory computer-readable medium; and
program instructions stored on the non-transitory computer-readable medium that are executable by the at least one processor to cause the computing system to carry out a method that comprises:

obtaining a first time series data array representing values of a set of one or more parameters related to the physical operation of a given asset from a first time, wherein at least some of the values comprise measurements collected by one or more sensors at the given asset;

performing a first comparison between the first time series data array and a set of historical time series data arrays, wherein each respective historical time series data array in the set of historical time series data arrays represents respective past values of the set of one or more parameters related to the physical operation of the given asset from a respective past time;

based on the first comparison, identifying a subset of historical time series data arrays that are similar to the first time series data array by (i) deriving a respective measure of similarity between the first time series data array and each respective historical time series data array in the set of historical time arrays and (ii) identifying the historical time series data arrays in the set of historical time arrays that have the best respective measures of similarity;

obtaining first event data associated with the first time series data array, wherein the first event data indicates one or more event occurrences that happened at or near the first time of the first time series data array, and wherein the one or more event occurrences includes at least one of (a) an occurrence of a particular type of anomalous condition at the given asset, (b) an occurrence of a particular type of weather event, or (c) an occurrence of a particular type of man-made event;

performing a second comparison between the first event data and respective historical event data associated with each of the subset of historical time series data arrays, wherein the respective historical event data associated with each respective

historical time series data array in the subset of historical time series data arrays indicates one or more past event occurrences that happened at or near the respective past time of the respective historical time series data array, and wherein the one or more past event occurrences includes at least one of (a) an occurrence of a particular type of anomalous condition at the given asset, (b) an occurrence of a particular type of weather event, or (c) an occurrence of a particular type of man-made event;

based on the second comparison, identifying one or more historical time series data arrays in the subset of historical time series data arrays that have associated historical event data indicating one or more past event occurrences of a same type as the one or more event occurrences indicated by the first event data and then filtering the subset of historical time series data arrays down to the identified one or more historical time series data arrays;

training a time series forecast model using the identified one or more historical time series data arrays;

generating a forecast of a future value of at least one parameter of the set of one or more parameters related to the physical operation of the given asset using the trained time series forecast model; and

transmitting data indicating the forecast of the future value of at least one parameter to an output system.

2. The computing system of claim 1, wherein the program instructions that are executable by the at least one processor to cause the computing system to carry out the method comprise program instructions that are executable by the at least one processor to cause the computing system to carry out the method in response to one or more of (a) a period of time expiring, (b) receiving a request to generate a forecast, (c) detecting a temporal change, or (d) detecting a change in at least one parameter of the set of one or more parameters.

3. The computing system of claim 1, wherein the one or more event occurrences indicated by the first event data comprise one or more event occurrences that are expected to affect the physical operation of the given asset subsequent to the first timeframe.

4. The computing system of claim 1, wherein one or more of the first time of the first time series data array or the respective past time of each respective historical time series data array comprises a range of time.

5. The computing system of claim 1, wherein the given asset comprises one of a transportation machine, an industrial machine, or a utility machine.

6. The computing system of claim 1, wherein the first event data and the historical event data comprises event codes.

7. A non-transitory computer-readable medium having program instructions stored thereon that are executable by at least one processor of a computing system to cause the computing system to carry out a method that comprises:

obtaining a first time series data array representing values of a set of one or more parameters from a first time, wherein at least some of the values comprise measurements collected by one or more sensors at the given asset;

performing a first comparison between the first time series data array and a set of historical time series data arrays, wherein each respective historical time series data array in the set of historical time series data arrays represents respective past values of the set of one or more parameters related to the physical operation of the given asset that were collected from a respective past time;

based on the first comparison, identifying a subset of historical time series data arrays that are similar to the first time series data array by (i) deriving a respective measure of similarity between the first time series data array and each respective historical time series data array in the set of historical time arrays and (ii) identifying the historical time series data arrays in the set of historical time arrays that have the best respective measures of similarity;

obtaining first event data associated with the first time series data array, wherein the first event data indicates one or more event occurrences that happened at or near the first time of the first time series data array, and wherein the one or more event occurrences includes at least one of (a) an occurrence of a particular type of anomalous condition at the given asset, (b) an

occurrence of a particular type of weather event, or (c) an occurrence of a particular type of man-made event;

performing a second comparison between the first event data and respective historical event data associated with each of the subset of historical time series data arrays, wherein the respective historical event data associated with each respective historical time series data array in the subset of historical time series data arrays indicates one or more past event occurrences that happened at or near the respective past time of the respective historical time series data array, and wherein the one or more past event occurrences includes at least one of (a) an occurrence of a particular type of anomalous condition at the given asset, (b) an occurrence of a particular type of weather event, or (c) an occurrence of a particular type of man-made event;

based on the second comparison, identifying one or more historical time series data arrays in the subset of historical time series data arrays that have associated historical event data indicating one or more past event occurrences of a same type as the one or more event occurrences indicated by the first event data and then filtering the subset of historical time series data arrays down to the identified one or more historical time series data arrays;

training a time series forecast model using the identified one or more historical time series data arrays;

generating a forecast of a future value of at least one parameter of the set of one or more parameters related to the physical operation of the given asset using the trained time series forecast model; and

transmitting data indicating the forecast of the future value of at least one parameter to an output system.

8. The non-transitory computer-readable medium of claim 7, wherein the program instructions that are executable by the at least one processor to cause the computing system to carry out the method comprise program instructions that are executable by the at least one processor to cause the computing system to carry out the method in response to one or more of (a) a period of time expiring, (b) receiving a request to generate a forecast, (c) detecting a temporal change, or (d) detecting a change in at least one parameter of the set of one or more parameters.

9. The non-transitory computer-readable medium of claim 7, wherein the one or more event occurrences indicated by the first event data comprise one or more event occurrences that are expected to affect the physical operation of the given asset subsequent to the first timeframe.

10. The non-transitory computer-readable medium of claim 7, wherein one or more of the first time of the first time series data array or the respective past time of each respective historical time series data array comprises a range of time.

11. The non-transitory computer-readable medium of claim 7, wherein the given asset comprises one of a transportation machine, an industrial machine, or a utility machine.

12. The non-transitory computer-readable medium of claim 7, wherein the first event data and the historical event data comprises event codes.

13. A computer-implemented method comprising:
obtaining a first time series data array representing values of a set of one or more parameters associated with a system related to the physical operation of a given asset from a first time, wherein at least some of the values comprise measurements collected by one or more sensors at the given asset;

performing a first comparison between the first time series data array and a set of historical time series data arrays, wherein each respective historical time series data array in the set of historical time series data arrays represents respective past values of the set of one or more parameters related to the physical operation of the given asset from a respective past time;

based on the first comparison, identifying a subset of historical time series data arrays that are similar to the first time series data array by (i) deriving a respective measure of similarity between the first time series data array and each respective historical time series data array in the set of historical time arrays and (ii) identifying the historical time series data arrays in the set of historical time arrays that have the best respective measures of similarity;

obtaining first event data associated with the first time series data array, wherein the first event data indicates one or more event occurrences that happened at or near the first time of the

first time series data array, and wherein the one or more event occurrences includes at least one of (a) an occurrence of a particular type of anomalous condition at the given asset, (b) an occurrence of a particular type of weather event, or (c) an occurrence of a particular type of man-made event;

performing a second comparison between the first event data and respective historical event data associated with each of the subset of historical time series data arrays, wherein the respective historical event data associated with each respective historical time series data array in the subset of historical time series data arrays indicates one or more past discrete, intermittent event occurrences that happened at or near the respective past time of the respective historical time series data array, and wherein the one or more past event occurrences includes at least one of (a) an occurrence of a particular type of anomalous condition at the given asset, (b) an occurrence of a particular type of weather event, or (c) an occurrence of a particular type of man-made event;

based on the second comparison, identifying one or more historical time series data arrays in the subset of historical time series data arrays that have associated historical event data indicating one or more past event occurrences of a same type as the one or more event occurrences indicated by the first event data and then filtering the subset of historical time series data arrays down to the identified one or more historical time series data arrays;

training a time series forecast model using the identified one or more historical time series data arrays;

generating a forecast of a future value of at least one ~~parameters~~ parameter of the set of one or more parameters related to the physical operation of the given asset using the trained time series forecast model; and

transmitting data indicating the forecast of the future value of at least one parameter to an output system.

14. The computer-implemented method of claim 13, wherein the method is carried out in response to one or more of (a) a period of time expiring, (b) receiving a request to generate a forecast, (c) detecting a temporal change, or (d) detecting a change in at least one parameter of the set of one or more parameters.

15. The computer-implemented method of claim 13, wherein the one or more event occurrences indicated by the first event data comprise one or more event occurrences that are expected to affect the physical operation of the given asset subsequent to the first timeframe.

16. The computer-implemented method of claim 13, wherein one or more of the first time of the first time series data array or the respective past time of each respective historical time series data array comprises a range of time.

17. The computer-implemented method of claim 13, wherein the given asset comprises one of a transportation machine, an industrial machine, or a utility machine.