CLAIMS

1. A computer-implemented method for air traffic control performance monitoring, comprising executing on one or more processors the steps of:

receiving traffic data;

receiving human data;

integrating the traffic data and the human data spatially and over time;

calculating tactical air traffic complexity;

identifying an eye signature associated with a tactical monitoring activity; and

integrating the calculated tactical air traffic complexity and the eye signature to deduce a monitoring strategy being applied.

2. The computer-implemented method for air traffic control performance monitoring according to claim 1, wherein the step of integrating the traffic data and the human data spatially and over time comprises:

synchronizing the traffic data and the human data based on timestamps.

3. The computer-implemented method for air traffic control performance monitoring according to claim 2, wherein the step of integrating the traffic data and the human data spatially and over time further comprises:

converting the synchronized traffic data and the synchronized human data into a same unit of measurement.

4. The computer-implemented method for air traffic control performance monitoring according to claim 3, wherein the step of integrating the traffic data and the human data spatially and over time further comprises:

aligning the converted traffic data and the converted human data to a spatial reference frame.

5. The computer-implemented method for air traffic control performance monitoring according to claim 4, wherein the step of integrating the traffic data and the human data spatially and over time further comprises:

fusing the aligned traffic data and the aligned human data.

6. The computer-implemented method for air traffic control performance monitoring according to any one of the preceding claims, wherein the step of calculating tactical air traffic complexity comprises:

forming three-dimensional (3D) aircraft movement shapes using aircraft flight parameters; and

determining a level of conflict activity based on a degree of overlap between the aircraft movement shapes.

7. The computer-implemented method for air traffic control performance monitoring according to claim 6, wherein the step of calculating tactical air traffic complexity further comprises:

generating a profile of the level of conflict activity over time.

8. The computer-implemented method for air traffic control performance monitoring according to any one of the preceding claims, wherein the step of identifying the eye signature associated with the tactical monitoring activity comprises:

plotting a fixation count and a fixation duration against an elapsed frame number for aircraft pairs-in-crossing; and

identifying a plurality of fixation peaks where the fixation count or the fixation duration is greater than an average number of non-zero fixation counts or non-zero fixation durations over time.

9. The computer-implemented method for air traffic control performance monitoring according to claim 8, wherein the step of identifying the eye signature associated with the tactical monitoring activity further comprises:

aligning the fixation peaks according to location to form a plurality of aligned fixation peak signatures.

10. The computer-implemented method for air traffic control performance monitoring according to claim 9, wherein the step of identifying the eye signature associated with the tactical monitoring activity further comprises:

evaluating the aligned fixation peak signatures by determining a number of non-aligned fixation peaks, a total number of aligned fixation peaks, a total fixation count and a total fixation duration of the aligned fixation peaks.

11. The computer-implemented method for air traffic control performance monitoring according to claim 10, wherein the step of identifying the eye signature associated with the tactical monitoring activity further comprises:

generating cumulative plots in respect of the total number of aligned fixation peaks, the total fixation count and the total fixation duration of the aligned fixation peaks against the elapsed frame number for aircraft pairs-in-crossing.

12. The computer-implemented method for air traffic control performance monitoring according to any one of the preceding claims, wherein the step of identifying the eye signature associated with the tactical monitoring activity comprises:

receiving a request to switch frequency in respect of an aircraft;

determining at least one fixation count in respect of the aircraft;

determining activation of a switching command in respect of the aircraft within a predetermined period; and

generating an aircraft frequency switch eye signature.

13. The computer-implemented method for air traffic control performance monitoring according to any one of the preceding claims, wherein the step of identifying the eye signature associated with the tactical monitoring activity comprises:

identifying a plurality of time intervals in which one or more mouseovers of an aircraft label and at least one fixation on the aircraft label occur over an aircraft flight path.

14. The computer-implemented method for air traffic control performance monitoring according to claim 13, wherein the step of identifying the eye signature associated with the tactical monitoring activity further comprises:

plotting total fixation count and total fixation duration of the identified time intervals against elapsed time to generate a time profile of the identified time intervals.

15. The computer-implemented method for air traffic control performance monitoring according to claim 14, wherein the step of identifying the eye signature associated with the tactical monitoring activity further comprises:

calculating aircraft sector duration;

calculating time difference between respective ones of the identified time intervals;

calculating a probability of each of the identified time intervals occurring based on the time difference between the respective ones of the identified time intervals and the aircraft sector duration; and

calculating an information entropy based on the probability of each of the identified time intervals occurring.

16. The computer-implemented method for air traffic control performance monitoring according to any one of the preceding claims, wherein the step of integrating the calculated tactical air traffic complexity and the eye signature to deduce the monitoring strategy being applied comprises:

identifying one or more instances of change in the calculated tactical air traffic complexity and the eye signature; and

contextualising the one or more instances of change to deduce the monitoring strategy being applied.

17. A non-transitory computer-readable memory storing computer program instructions executable by a computer processor to perform operations for air traffic control performance monitoring, the operations comprising:

receiving traffic data;

receiving human data;

integrating the traffic data and the human data spatially and over time;

calculating tactical air traffic complexity;

identifying an eye signature associated with a tactical monitoring activity; and

integrating the calculated tactical air traffic complexity and the eye signature to deduce a monitoring strategy being applied.

18. The non-transitory computer-readable memory according to claim 17, wherein the operation of integrating the traffic data and the human data spatially and over time comprises:

synchronizing the traffic data and the human data based on timestamps.

19. The non-transitory computer-readable memory according to claim 18, wherein the operation of integrating the traffic data and the human data spatially and over time further comprises:

converting the synchronized traffic data and the synchronized human data into a same unit of measurement.

20. The non-transitory computer-readable memory according to claim 19, wherein the operation of integrating the traffic data and the human data spatially and over time further comprises:

aligning the converted traffic data and the converted human data to a spatial reference frame.

21. The non-transitory computer-readable memory according to claim 20, wherein the operation of integrating the traffic data and the human data spatially and over time further comprises:

fusing the aligned traffic data and the aligned human data.

22. The non-transitory computer-readable memory according to any one of claims 17 to 20, wherein the operation of calculating tactical air traffic complexity comprises:

forming three-dimensional (3D) aircraft movement shapes using aircraft flight parameters; and

determining a level of conflict activity based on a degree of overlap between the aircraft movement shapes.

23. The non-transitory computer-readable memory according to claim 22, wherein the operation of calculating tactical air traffic complexity further comprises:

generating a profile of the level of conflict activity over time.

24. The non-transitory computer-readable memory according to any one of claims 17 to 23, wherein the operation of identifying the eye signature associated with the tactical monitoring activity comprises:

plotting a fixation count and a fixation duration against an elapsed frame number for aircraft pairs-in-crossing; and

identifying a plurality of fixation peaks where the fixation count or the fixation duration is greater than an average number of non-zero fixation counts or non-zero fixation durations over time.

25. The non-transitory computer-readable memory according to claim 24, wherein the operation of identifying the eye signature associated with the tactical monitoring activity further comprises:

aligning the fixation peaks according to location to form a plurality of aligned fixation peak signatures.

26. The non-transitory computer-readable memory according to claim 25, wherein the operation of identifying the eye signature associated with the tactical monitoring activity further comprises:

evaluating the aligned fixation peak signatures by determining a number of non-aligned fixation peaks, a total number of aligned fixation peaks, a total fixation count and a total fixation duration of the aligned fixation peaks.

27. The non-transitory computer-readable memory according to claim 26, wherein the operation of identifying the eye signature associated with the tactical monitoring activity further comprises:

generating cumulative plots in respect of the total number of aligned fixation peaks, the total fixation count and the total fixation duration of the aligned fixation peaks against the elapsed frame number for aircraft pairs-in-crossing.

28. The non-transitory computer-readable memory according to any one of claims 17 to 27, wherein the operation of identifying the eye signature associated with the tactical monitoring activity comprises:

receiving a request to switch frequency in respect of an aircraft;

determining at least one fixation count in respect of the aircraft;

determining activation of a switching command in respect of the aircraft within a predetermined period; and

generating an aircraft frequency switch eye signature.

29. The non-transitory computer-readable memory according to any one of claims 17 to A12, wherein the operation of identifying the eye signature associated with the tactical monitoring activity comprises:

identifying a plurality of time intervals in which one or more mouseovers of an aircraft label and at least one fixation on the aircraft label occur over an aircraft flight path.

30. The non-transitory computer-readable memory according to claim 29, wherein the operation of identifying the eye signature associated with the tactical monitoring activity further comprises:

plotting total fixation count and total fixation duration of the identified time intervals against elapsed time to generate a time profile of the identified time intervals.

31. The non-transitory computer-readable memory according to claim 30, wherein the operation of identifying the eye signature associated with the tactical monitoring activity further comprises:

calculating aircraft sector duration;

calculating time difference between respective ones of the identified time intervals;

calculating a probability of each of the identified time intervals occurring based on the time difference between the respective ones of the identified time intervals and the aircraft sector duration; and

calculating an information entropy based on the probability of each of the identified time intervals occurring.

32. The non-transitory computer-readable memory according to any one of claims 17 to 31, wherein the operation of integrating the calculated tactical air traffic complexity and the eye signature to deduce the monitoring strategy being applied comprises:

identifying one or more instances of change in the calculated tactical air traffic complexity and the eye signature; and

contextualising the one or more instances of change to deduce the monitoring strategy being applied.

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