

CLAIMS

1. A method implemented in an Air-Traffic Control system, said method
5 comprising receiving as input a set of Air-Traffic Control, ATC situations from
at least one data storage medium, each ATC situation being defined by a
sector of an airspace and a time period, the ATC situation having occurred in
said sector and in said time period, each ATC situation being associated with
a set of parameters stored in said at least one data storage medium, said set
10 input parameters being representative of the processing complexity of the
sector corresponding to the ATC situation and comprising:

- aircraft paths corresponding to paths of aircraft having crossed the
sector of the ATC situation;
- meteorological information for the sector and the time period of the ATC
15 situation;

said method comprising, for each ATC situation:

- a step of forming a vector of input parameters comprising parameters of
the set of parameters associated with the ATC situation;
- a step of computing an ATC-complexity index of the situation, on the
20 basis of the input parameters, using a complexity computing function
applied to said input parameters, said complexity computing function
being an analytical function;

said method comprising a step of training a supervised machine-learning
engine that has as input associations, for each ATC situation respectively,
25 between its vector of input parameters and its ATC-complexity index, said
vector of input parameters serving as a feature vector and said complexity
index serving as a label,

the method further comprising executing the trained machine learning engine
to predict the complexity index of a given ATC situation in a given sector,

30 wherein the method comprises using said complexity index to dynamically
redefine one or more sectors or to dynamically assign air-traffic controllers to
one or more sectors.

2. The method as claimed in claim 1, comprising, for at least one ATC situation, applying reinforcement learning on the basis of data representative of the workload experienced by an air-traffic controller in the situation.
- 5 3. The method as claimed in one of claims 1 to 2, comprising, for at least one ATC situation, a step of computing variations in the ATC-complexity index on the basis of data representative of the workload experienced by an air-traffic controller in the situation, which data are recorded for the sector and during the time period, and of applying reinforcement learning to the supervised machine-learning engine, on the basis of the variations.
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4. The method as claimed in one of claims 1 to 3 comprising, for each ATC situation, a step of applying reinforcement learning to the supervised learning engine, this comprising:
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 - presenting an ATC situation, and an ATC-complexity index computed by the supervised learning engine for this situation, to at least one air-traffic controller;
 - receiving a complexity-index discrepancy entered by the at least one air-traffic controller;
 - 20 - applying a penalty to the learning depending on this discrepancy.
5. The method as claimed in one of claims 1 to 4, comprising a step of comparing sector grouping and ungrouping predictions made on the basis of ATC-complexity indices computed by the machine-learning engine and sector grouping and ungrouping, in said set of ATC situations, by controllers.
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6. The method as claimed in claim 5, comprising validating the training of the supervised learning engine on the basis of said comparisons.
- 30 7. The method as claimed in one of claims 5 to 6, comprising applying reinforcement learning to the supervised learning engine on the basis of said comparisons.

8. An Air-Traffic Control system, said system being a computing system and comprising:

- a processor able to train a supervised machine-learning engine;

wherein the system comprises:

- an access to at least one data storage medium storing, for a set of Air-Traffic Control, ATC situations each ATC situation being defined by a sector of an airspace and a time period, the ATC situation having occurred in said sector and in said time period, each ATC situation being associated with a set of parameters stored in said at least one data storage medium, said set of parameters being representative of the processing complexity of the sector corresponding to the ATC situation and comprising:

- aircraft paths corresponding to paths of aircraft having crossed the sector of the ATC situation;
- meteorological information for the sector and the time period of the ATC situation;

the processor able, for each ATC situation, to:

- form a vector of input parameters comprising parameters of the set of parameters associated with the ATC situation;
- compute an ATC-complexity index of the situation, on the basis of the input parameters, using a complexity computing function applied to said input parameters, said complexity computing function being an analytical function;

the processor being able to train a supervised machine-learning engine that has as input associations, for each ATC situation respectively, between its vector of input parameters and its ATC-complexity index, said vector of input parameters serving as a feature vector and said complexity index serving as a label,

the processor being able to execute the trained machine learning engine to predict the complexity index of a given ATC situation in a given sector,

wherein the processor is able to use said complexity index to dynamically redefine one or more sectors or to dynamically assign air-traffic controllers to one or more sectors.

9. A computer program product comprising program code instructions for executing the steps of the method as claimed in one of claims 1 to 7 when said program is executed on a computer.
- 5 10. The method of claim 1, wherein the method comprises solving a constrained optimization problem, aiming to minimize the total number of sectors in an airspace, while ensuring that the ATC complexity computed by the supervised learning engine for each sector and time period is less than a predefined complexity.