CLAIMS

1. A computer implemented method of building a computer implemented data classifier for classifying data from a specified context (C1), said method comprising the steps of:
obtaining a Probabilistic Graphical Model comprising a set of Variables comprising a first set of Observable Variables (Var1, Var2, Var3, …VarN), and a class Variable , whereby said probabilistic model comprises parameters defining dependencies between the Variables of said set of Variables,
obtaining a machine learning model that is trained on second training data (D2) comprising a second set of Observable Variables (VarA, VarB, …VarZ),
extending said Probabilistic Graphical Model to comprise one or more Extension Variables (VarX1, VarX2, … VarXN), each said Extension Variable corresponding to the outputs of said machine learning model, and
performing an embedding training of said extended Probabilistic Graphical Model on the basis of an embedding training set of data, said embedding training set comprising first training data (D1.1) of data from said specified context (C1) and an inferred machine learning model output (, O1.2) inferred by said machine learning model from third training data (D1.2) from context C1 corresponding to said second set of Observable Variables (VarA, VarB, …VarZ), whereby third training data (D1.2) is sampled from said context (C1) together with said first training data (D1.1), to obtain an enhanced Probabilistic Graphical Model comprising parameters defining dependencies between said Observable Variables, said class Variable and each said Extension Variable.

2. The method of any preceding claim wherein there are provided one or more further machine learning models each said further machine learning model comprising said second set of Observable Variables (VarA, VarB …VarZ), and each said further machine learning model output O1.2 comprising probabilities corresponding to the values of said Extension Variables (VarX1, VarX2 …, VarXN) of said extended Probabilistic Graphical Model, and wherein
said step of performing an embedding training of said extended Probabilistic Graphical Model is performed, such that conditional probability tables of said Extension Variables (VarX1, VarX2 …, VarXN) are obtained.

3. The method of any preceding claim wherein there are provided one or more further machine learning models each said further machine learning model comprising said second set of Observable Variables (VarA, VarB, …VarZ), and each said further machine learning model output O1.2 comprising values that are not probabilities, said values corresponding to the states of Observed Extension Variables, a subset of said Extension Variables (VarX1, VarX2, … VarXN), whereas the rest of said Extension Variables are Latent Extension Variables , wherein said Observed Extension Variables are conditioned on said Latent Extension Variables, and said step of performing an embedding training of a Probabilistic Graphical Model is performed such that for each said Observed Extension Variable and each said Latent Extension Variable a specific probability table is obtained.

4. The method of any preceding claim wherein said step of training said machine learning model comprises incorporating said machine learning model as the Latent representation of an autoencoder.

5. The method of any preceding claim in which said machine learning model is trained in an unsupervised mode.

6. The method of any preceding claim wherein said context comprises the conditions corresponding to the geographic locations, time and the type of moving entities in a physical space under which the data is sampled.

7. The method of any preceding claim wherein said first training data, second training data and third training data comprise kinematic data for moving entities in a physical space.

8. The method of claim 7 wherein said first training data, second training data and third training data further comprise images, video streams, sound or electromagnetic signatures.

9. A method of classifying data comprising presenting said data to a data classifier in accordance with any of claims 1 to 8.

10. The method of any preceding claim applied to classification of targets in combat management systems, or in processing of sensor observations or detections of moving targets, wherein the first set of Observable Variables (Var1, Var2, Var3, … VarN) and the second set of Observable Variables (VarA, VarB, VarC, … VarZ) correspond to (i) the outputs of various sensors perceiving the targets and (ii) outputs of sources describing the environmental conditions and wherein the dependencies between said Observable Variables, said class Variable and each said Extension Variable describe the correlations between the context, the observations and the target class, enabling classification of a target, prediction of its states or detection of anomalous target states.

11. The method of any of claims 1 to 8 applied to detection of anomalies in IT systems, cyber physical systems and detection of cyber attacks, wherein the first set of Observable Variables (Var1, Var2, Var3, … VarN) and the second set of Observable Variables (VarA, VarB, VarC, … VarZ) correspond to the readings from various IDS probes at different system levels and wherein the dependencies between said Observable Variables, said class Variable and each said Extension Variable describe the correlations between different components of the overall system, such that the states of unobservable components can be predicted or anomalous states of components can be detected.

12. A data processing system comprising means for carrying out the steps of the method of any of claims 1 to 11.

13. A radar processing system, combat management system or sensor processing system, comprising the data processing system of claim 12.

14. A ship, for example a navy ship, comprising a combat management system according to claim 13.

15. A computer program comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method of any of claims 1 to 11.

16. A computer-readable medium comprising instructions which, when executed by a computer, cause the computer to carry out the method of any of claims 1 to 11.