Explanation Methods for Multivariate Time Series Classification

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Scientific Context: Various data series classification algorithms have been proposed in the past few years [1], including several deep learning methods [2]. The advantages of a deep learning model are that it can benefit from GPU accelerations, and use Class Activation Maps (CAMs) [2] to explain the classification results. Nevertheless, the CAM only provides a univariate data series regardless of the dimensionality of the input. Thus, for the case of multivariate data series, CAM will only be able to highlight significant temporal events without any information on which dimensions are relevant.

Objectives: We will extend the CAM method for multivariate data series classification and anomaly detection. We will continue our ongoing work on novel methods that can provide a multivariate CAM. Such a method should be able to identify discriminant features inside each dimension. Figure 1(c) shows an example of the desired output. The subsequences highlighted in yellow should correspond to discriminant subsequences. We will also study extensions, such that the explanation provided is rich enough to consider time dependencies between discriminant features. Figure 1(d) illustrates the desired output. Such explanations would provide to the analysts much richer information to understand the decision of a deep learning model.

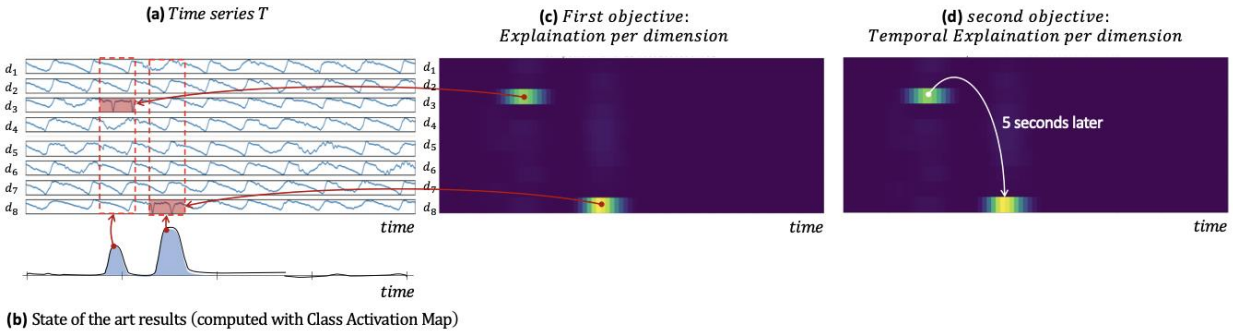

Figure 1: State of the art explanation methods and objectives of this internship.

Internship info: This internship is supervised by Prof. Themis Palpanas and his PhD student Paul Boniol from the diNo team at the University of Paris. The selected intern will become a member of diNo, which has world-leading expertise on data series management, indexing, and analysis.

Prerequisites: Excellent Python programming skills, very good knowledge of deep learning frameworks (PyTorch/GPU, etc.) and libraries in data analysis workflow (NumPy, Matplotlib, etc.). Research/project experiments and publications on deep learning or data analysis is a plus.

How to apply: Apply by emailing your CV and transcripts to Prof. Themis Palpanas: themis@mi.parisdescartes.fr

References:

[1] A. Bagnall, J. Lines, A. Bostrom, J. Large, and E. Keogh, "The great time series classification bake off: a review and experimental evaluation of recent algorithmic advances," Data Mining and Knowledge Discovery, vol. 31, 11 2016.
[2] H. I. Fawaz, G. Forestier, J. Weber, L. Idoumghar, and P. Muller, "Deep learning for time series classification: a review," CoRR, vol. abs/1809.04356, 2018. [Online]. Available: http://arxiv.org/abs/1809. 04356