Other Applications

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We applied nonlinear factor analysis to novelty detection for structural health monitoring in [1]. In vibration-based structural health monitoring damage in structure is tried to detect from damage-sensitive features. Because neither prior information nor data about expected damage are normally available, damage detection problem must be solved by using a novelty detection approach. Features, which are sensitive to damage, are often sensitive to environmental and operational variations. Therefore elimination of these variations is essential for reliable damage detection. At present many of the damage detection methods are linear, though it has been shown that many of the vibration changes in structures are bilinear or nonlinear. We proposed to use nonlinear factor analysis to detect damage via elimination of external effectsfrom damage features. The effectiveness of the proposed method was demonstrated by analyzing the experimental Z24 Bridge data with a comparison to a linear method [1]. It was shown that elimination of adverse effects and damage detection are feasible.

In [2], we studied document classification utilising relational information. Two major types of relational information can be utilized in automatic document classification as background information: relations between terms, such as ontologies, and relations between documents, such as web links or citations in articles. We introduced a model where a traditional bag-of-words type classifier is gradually extended to utilize both of these information types. The experiments with data from the Finnish National Archive show that classification accuracy improves from 70% to 74% when the General Finnish Ontology YSO is used as background information, without using relations between documents.

References

[1] V. Lämsä and T. Raiko. Novelty Detection by Nonlinear Factor Analysis for Structural Health Monitoring. In IEEE International Workshop on Machine Learning for Signal Processing (MLSP 2010), pages 468–473, Kittilä, Finland, August, 2010.

[2] K. Nyberg, T. Raiko, T. Tiinanen, and E. Hyvönen. Document Classification Utilising Ontologies and Relations between Documents, In Proc. of the 8th Workshop on Mining and Learning with Graphs (MLG 2010), Washington DC, USA, July, 2010.