HADI BANAEE received his MSc in Computational Complexity from the Department of Computer Science, Amirkabir University of Technology (Tehran Polytechnic), Iran in 2011. In 2012 he joined the Center of Applied Autonomous Sensor Systems (AASS) of Örebro University in Sweden as a doctoral student. His research interests include various aspects of AI and cognitive science such as machine learning, knowledge representation and natural language generation, with a particular focus on semantic representations of numerical sensor data.

With the increased availability of data comes from sensors the increased need of systems that can represent the data in human interpretable concepts. In order to describe unknown observations in natural language, an artificial intelligence system must deal with several issues involving perception, concept formation, and linguistic description. This thesis addresses the problem of semantically modelling and describing numerical observations from sensor data. The research considers creating a semantic representation using the theory of conceptual spaces by introducing a data-driven approach that automatically constructs conceptual spaces from perceived numerical data sets. This conceptual space then utilises semantic inference techniques to derive linguistic interpretations for novel unknown observations. The thesis further explores an instantiation of the proposed approach in order to be used to describe unknown time series patterns that emerge from physiological sensor data. This instantiation presents data analysis methods to extract such patterns, and then applies the proposed semantic representation to generate human-readable descriptions. The main outcome of this thesis is the use of data-driven strategies that enable the system to reveal and explain hidden aspects of sensor data. Briefly put, the thesis aims to automate the process whereby unknown observations of data can be 1) numerically analysed, 2) semantically represented, and eventually 3) linguistically described.

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A Data-driven Approach for Generating Linguistic Descriptions

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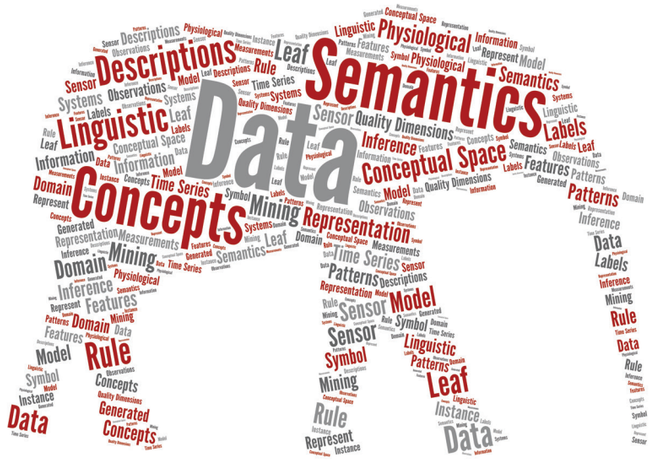

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