Hyperdimensional Computing and Vector Symbolic Architectures in Neural Networks

Special Session of the IEEE World Congress on Computational Intelligence (IJCNN 2022) – Call for Papers

SCOPE AND MOTIVATION

Vector Symbolic Architectures (VSA), also known as Hyperdimensional Computing (HDC), are a subclass of cognitive computing architectures based on the observation that mathematical properties of high-dimensional spaces can aid the explanation of human perception. In VSA, information is represented in vectors of very large dimensionality (several thousand bits). In this framework, it is possible to define very large vectors with high dimensionality that can be used with simple operations to model memory and cognition.

In this regard, HDC and VSA principles can be extremely helpful to design, implement and explain neural network models, with the goal of simplifying and efficiently interpret AI functionalities. The ability to map large data and big structures in long binary vectors that can be manipulated with binding and superposition is the main advantage of using HDC and VSA, because neural networks inner workings can be modeled as such, to the point of ideally constructing a complete learning system based on those concepts.

This special session, which is hosted in the International Joint Conference on Neural Networks (IJCNN 2022) of WCCI 2022, is intended to bring forth advances in neural network architectures and applications via HDC/VSA. Submitted papers should propose novel algorithms or systems based on neural networks employing HDC/VSA with the goal of showing new solutions to supervised learning problems and applications or providing original insights on neural methods.

Submitted papers should focus on paving the way for the study of a whole artificial intelligence system based on the HDC/VSA principles, exploring the possibilities of theorizing a whole family of new machine learning models, being able to develop a taxonomy of all the methods that have been implemented at the state of the art. Furthermore, the possibility opened by recent advances in brain-inspired technologies and approximate computation in general have great potential to be developed further with HDC and VSA principles. In particular, the latest applications of VSA computing in energy-aware AI developments are an incredible possibility for exploiting machine learning usefulness on such novel computing stages in full potential.

TOPICS

Topics of the special session include but are not limited to:

- HD vectors as input/output to neural networks
- HD vectors in randomized neural networks
- HDC/VSA primitives in neural networks design
- Explaining neural networks and brain-inspired computation with HDC/VSA
- Energy-aware AI developments by using VSA computing

- Theoretical analysis of HDC-based methods
- Distributed learning with HDC/VSA
- Hardware implementation of HDC-based architectures and systems
- Applications of HDC in real domains such as Pattern Recognition, Time Series Prediction, Computer Vision, Language Processing, etc.

IMPORTANT DATES

- January 31, 2022 – Paper submission (STRICT DEADLINE!)
- April 26, 2022 – Notification of acceptance
- May 23, 2022 – Final paper submission
- July 18-23, 2021 – Conference in Padua, Italy

PAPER SUBMISSION

Papers submitted to this Special Session are reviewed according to the same rules (i.e. double-blind) as the submissions to the regular sessions of WCCI 2022. Authors who submit papers to this session are invited to mention it in the form during the submission. Submissions to regular and special sessions follow identical format, instructions, deadlines and procedures of the other papers.

For further information and news, you may refer to the WCCI 2022 website: https://wcci2022.org

**Please select as the main research topic of the submission the Special Session ID:
"IJCNN-SS-28: Hyperdimensional Computing and Vector Symbolic Architectures in Neural Networks"**

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