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Advances in Knowledge-Based Technologies

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Program

Session 1. Chair: Susanne Saminger-Platz

15:00 G. Raju:
What's Wrong with Convolution Neural Networks
15:30 M. Kumar:
Fuzzy Theoretic Nonparametric Deep Learning

What is Wrong with Convolution Neural Networks

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Abstract. The Convolution Neural Networks(CNN) or ConvNets are the deep variants of the Artificial Neural Network computational models. CNNs proved to recognize patterns with extreme variability and robustness to distortions and simple geometric transformations. The major goal of the researchers is to bring computer vision performance close to the human vision, they tried different crazy combinations such as stacking many layers, multiple sub networks and skip connections to increase accuracy and advance the research. The main failure of CNNs is that they do not carry any information about the relative relationships between features. This is simply a flaw in the core design of CNNs since they are based on the basic convolution operation applied to scalar values. This talk mainly focus on how to preserve hierarchical pose relationships between features using capsule theory. Capsule is a nested set of neural layer used to better model these relationships inside the network, it becomes very easy for it to understand that the thing that it sees is just another view of something that it has seen before, since its not just relying on independent features; its now putting those features together to form a more complete representation of its knowledge by introducing routing by agreement mechanism.

Keywords: Deep Learning · Max pooling · Activation functions · Computer Vision.

Fuzzy Theoretic Nonparametric Deep Learning

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The application of fuzzy theory to deep learning is limited 1) under the realm of deep neural networks; 2) to the parametric form of modeling; and 3) relying on gradient-descent based numerical algorithms for optimization because of lack of analytical solutions. This study fills this gap by providing an analytical nonparametric deep modeling solution based on the mathematical analysis of membership functions assigned to model variables. Our nonparametric approach is based on the concept of representing the unknown mappings (between input and output variables) through an infinite-dimensional Student-t type membership function. This concept is borrowed from Gaussian/Student-t processes based learning in kernel machines. The Student-t membership function based representation of a mapping is referred to as „Student-t fuzzy-mapping“ in this study. The most significant feature of this paper is to analytically derive the 'optimal' mathematical expressions for membership functions using variational optimization. The study focuses on the modeling of image features where a layer of the deep-model first projects the feature vector onto a lower dimensional subspace and then construct the output feature vector through Student-t fuzzy-mappings. The potential of the presented mathematical theory is demonstrated through numerous image classification experiments.