

Mixed Sum-Product and Convolutional Networks for Classification Problems

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Abstract. In this work, we propose a joint Sum-Product (SPN) and Convolutional (CNN) Network for classification problems, namely image classification performed on several real-life benchmark datasets. These mixed networks represent an original development within the probabilistic graphical models domain that outperform the traditional CNNs results.

After recalling the structural properties of SPNs with their theoretical foundations, we present the performance metrics (F1 score, Brier score, precision, recall and accuracy) obtained for four different datasets: the MNIST dataset, the Fashion MNIST dataset, the Fast, Furious and Insured dataset, and the Garbage Classification dataset, respectively. The results obtained for the last two datasets outperformed the results obtained by the classical deep learning methods.

The mixed networks proposed in this paper contribute to the understanding of SPN applications emphasizing possible further areas of study within the field.

References

- [1] H. Poon, P. Domingos, Sum-product networks: A new deep architecture, *IEEE International Conference on Computer Vision Workshops (ICCV Workshops)*, 2011, pp. 689-690.
- [2] D. Koller, N. Friedman, *Probabilistic Graphical Models: Principles and Techniques*, Cambridge, MA: MIT Press, 2009.