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Special Issue on Deep Neural Networks for Digital Media Algorithms

Foreword

Due to recent computer technology advancements the artificial neural networks (ANN), essentially with the same architecture as 20 years ago, have changed their status within digital media area. Then, for instance the linear discriminant analysis, i.e. LDA based face recognition systems outperformed their ANN counterparts. In general ANN classifiers were comparable in efficiency with specialized to the particular problem solutions only if good features were "manually" designed as input of ANN. Now, the convolutional neural networks (CNN) automatically design the features on the basis of raw digital media objects delivered as tensors and processed further in the consecutive layers as tensors, as well. A deep cascade of convolutional layers (DNN) creates an application oriented feature extractor, operating only with small kernels, and followed by primitive nonlinearities such as rectified linear units (ReLU), or pooling filters. In digital media research, the current power of DNN "floods new islands" of applications which were reserved for specialized approaches.

The outline of high performance DNN solutions for digital media applications, reflecting the recent status can be found in the comprehensive tutorial opening our special issue: *Symbolic Tensor Neural Networks for Digital Media – from Tensor Processing via BNF Graph Rules to CREAMS Applications.* In symbolic notations the complete architectures can be found for selected problems of the wide CREAMS family:

- Compression of digital image, video, and audio (efficient generative modeling).
- Recognition of semantic objects in media objects (including object detection, segmentation, classification, and verification).
- Embedding of one media object into another one (stego-analysis aspects, watermarking, etc.).
- Annotation, aka media indexing, captioning, and summarization.
- 3D Modeling for human computer interfacing including gaze and pose identification.
- Security schemes and algorithms to preserve intellectual property rights for digital arts.

The tutorial *Deep learning optimization tasks and metaheuristic methods* addresses directly to DNN frontier from the optimization point of view leading readers to methods beyond the stochastic gradient world.

Referring to the applications presented in this special issue we can observe that the majority of application focus on classification of medical signals and images. Authors present novel architectures and show experimentally the superiority of DNN solutions in medical applications.

The next topic of interest are visual emotions. It is insightful to observe in them how the classic 3D models interact with deep features build either directly or indirectly via transfer learning.

The paper *Comifixy: Transform video into comics* deserves for a special attention. The web page with this application has attracted thousands of Internet users. From video to comics - it is the goal of this research which is focused on the integration of existing solutions into a consistent pipeline of video/image processing operations. Essentially there two major tasks: video summarization (keyframes extracting) and video-comics style transfer. Each of major steps consists of several minor tasks part of which are realized by the DNN modules.

Concluding, we have a hope that the papers accepted to our special issue contribute to the ongoing scientific revolution moving rapidly the current frontier between the ”DNN ocean” and the ”special islands” which are still superior.

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