Literature Survey

Paper by Geoffrey Hinton:

A CNN might be very successful in recognizing the different elements of a face in an image - eyes, nose, mouth, and deducing that a section containing these - most probably represents a face. However, it will not be sensitive to the arrangement of the entities (mouth under nose, then two symmetric eyes above that), and might mistakenly recognize different arrangements of these entities as face.

There are multiple consequences for this shortcoming, but two major ones are:

* Misclassification of images that contain the “right” entities in a wrong pose, as explained above. Moreover, knowing that all the entities are arranged in a very specific relationship to one another (mouth under nose under eyes) - is a much stronger signal for the existence of a face, compared to just knowing they are there.
* Inefficient representation that leads to ineffective learning - instead of having a small canonical set per entity + pose information, every pose of the entity is modeled separately. That leads to a huge training set, which is orders of magnitude larger than what’s required for a human brain to learn the same classification / recognition.

Solution: Using segmentation and pca for feature extraction before CNN

Zhou, Y.; Li, Z.; Zhu, H.; Chen, C.; Gao, M.; Xu, K.; Xu, J. Holistic Brain Tumor Screening and Classification Based on DenseNet and Recurrent Neural Network. In International MICCAI Brainlesion Workshop; Springer: Berlin, Germany (2019)

A great deal of effort has been devoted to this problem, e.g., releasing publicly available benchmark datasets and organizing challenges . Many algorithms have been proposed to solve the brain tumor segmentation problem, such as Deep Neural Networks and

SVM with Conditional Random Field . Classifications based on SVM and/or

ANN are then followed to distinguish different types of brain tumors based on the

extracted features from ROIs. An obvious limitation of such frameworks is the

need of tracing ROIs, which can cause a few problems. Firstly, since brain tumors

can vary dramatically in their shapes, sizes, and locations, tracing ROIs could

be quite challenging and often not fully automatic. This may cause significant

errors to the segmentation, and be accumulated into the following phases, thus

leading to inaccurate classification.

Solution: using RNN or CNN to learn sequence-to-label mapping, with a DenseNet based auto-encoder for feature extraction.