**LITERATURE SURVEY**

**1) Constants across cultures in the face and emotion**

**AUTHORS:**  P. Ekman and W. V. Friese

Investigated the question of whether any facial expressions of emotion are universal. Recent studies showing that members of literate cultures associated the same emotion concepts with the same facial behaviors could not demonstrate that at least some facial expressions of emotion are universal; the cultures compared had all been exposed to some of the same mass media presentations of facial expression, and these may have taught the people in each culture to recognize the unique facial expressions of other cultures. To show that members of a preliterate culture who had minimal exposure to literate cultures would associate the same emotion concepts with the same facial behaviors as do members of Western and Eastern literate cultures, data were gathered in New Guinea by telling 342 Ss a story, showing them a set of 3 faces, and asking them to select the face which showed the emotion appropriate to the story. Ss were members of the Fore linguistic-cultural group, which up until 12 yr. ago was an isolated, Neolithic, material culture. Results provide evidence in support of the hypothesis

**2) Challenges in representation learning: A report on three machine learning contests**

**AUTHORS:** I. J. Goodfellow et al.,

The ICML 2013 Workshop on Challenges in Representation Learning focused on three challenges: the black box learning challenge, the facial expression recognition challenge, and the multimodal learning challenge. We describe the datasets created for these challenges and summarize the results of the competitions. We provide suggestions for organizers of future challenges and some comments on what kind of knowledge can be gained from machine learning competitions.

**3) Face recognition: A convolutional neural-network approach**

**AUTHORS:** S. Lawrence, C. L. Giles, A. Chung Tsoi, and A. D. Back

We present a hybrid neural-network for human face recognition which compares favourably with other methods. The system combines local image sampling, a self-organizing map (SOM) neural network, and a convolutional neural network. The SOM provides a quantization of the image samples into a topological space where inputs that are nearby in the original space are also nearby in the output space, thereby providing dimensionality reduction and invariance to minor changes in the image sample, and the convolutional neural network provides partial invariance to translation, rotation, scale, and deformation. The convolutional network extracts successively larger features in a hierarchical set of layers. We present results using the Karhunen-Loeve transform in place of the SOM, and a multilayer perceptron (MLP) in place of the convolutional network for comparison. We use a database of 400 images of 40 individuals which contains quite a high degree of variability in expression, pose, and facial details. We analyze the computational complexity and discuss how new classes could be added to the trained recognizer.

**4) Deep convolutional neural networks for computer-aided detection: CNN architectures, dataset characteristics and transfer learning,**

**AUTHORS:** H.-C. Shin, H. R. Roth, M. Gao, L. Lu, Z. Xu, I. Nogues, J. Yao,

D. Mollura, and R. M. Summers

Remarkable progress has been made in image recognition, primarily due to the availability of large-scale annotated datasets and deep convolutional neural networks (CNNs). CNNs enable learning data-driven, highly representative, hierarchical image features from sufficient training data. However, obtaining datasets as comprehensively annotated as ImageNet in the medical imaging domain remains a challenge. There are currently three major techniques that successfully employ CNNs to medical image classification: training the CNN from scratch, using off-the-shelf pre-trained CNN features, and conducting unsupervised CNN pre-training with supervised fine-tuning. Another effective method is transfer learning, i.e., fine-tuning CNN models pre-trained from natural image dataset to medical image tasks. In this paper, we exploit three important, but previously understudied factors of employing deep convolutional neural networks to computer-aided detection problems. We first explore and evaluate different CNN architectures. The studied models contain 5 thousand to 160 million parameters, and vary in numbers of layers. We then evaluate the influence of dataset scale and spatial image context on performance. Finally, we examine when and why transfer learning from pre-trained ImageNet (via fine-tuning) can be useful. We study two specific computer-aided detection (CADe) problems, namely thoraco-abdominal lymph node (LN) detection and interstitial lung disease (ILD) classification. We achieve the state-of-the-art performance on the mediastinal LN detection, and report the first five-fold cross-validation classification results on predicting axial CT slices with ILD categories. Our extensive empirical evaluation, CNN model analysis and valuable insights can be extended to the design of high performance CAD systems for other medical imaging tasks.

**5) Facial expression recognition based on complexity perception classification algorithm**

**AUTHORS:** T. Chang, G. Wen, Y. Hu, and J. Ma

Facial expression recognition (FER) has always been a challenging issue in computer vision. The different expressions of emotion and uncontrolled environmental factors lead to inconsistencies in the complexity of FER and variability of between expression categories, which is often overlooked in most facial expression recognition systems. In order to solve this problem effectively, we presented a simple and efficient CNN model to extract facial features, and proposed a complexity perception classification (CPC) algorithm for FER. The CPC algorithm divided the dataset into an easy classification sample subspace and a complex classification sample subspace by evaluating the complexity of facial features that are suitable for classification. The experimental results of our proposed algorithm on Fer2013 and CK-plus datasets demonstrated the algorithm's effectiveness and superiority over other state-of-the-art approaches.