Face expressions recognition using deep learning

A Thesis Submitted In Partial Fulfillment of

The Requirement for the Degree of

Doctor of Philosophy

In

Electrical Engineering

Electronic and Communication Engineering

By

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ABSTRACT

Human face expression recognition is an active research area that has massive applications in medical field, crime investigation, marketing, online learning, automobile safety and video games. The first part of this research defines a deep neural network model-based framework for recognizing the seven main types of facial expression, which are found in all cultures. The proposed methodology involves four stages: (a) pre-processing the FER2013 dataset through relabeling to avoid misleading results and getting rid of non-face and non-frontal faces; (b) design of an efficient stable Cycle Generative Adversarial Network (CycleGAN), which provides unsupervised expression-to-expression translation. The CycleGAN has been designed and trained with a new cycle consistency loss. (c) Generating new images to overcome the class imbalance and finally (d) building the DNN architecture for recognizing the face sign expression, using the pretrained VGG-Face model with vggface weights. The second part encompasses the design of a GPU-accelerated face expression recognition system for real time video sequences using NVIDIAs Compute Unified Device Architecture (CUDA). OpenCV library has been compiled from scratch with CUDA and NVIDIA CUDA Deep Neural Network library, cuDNN. For face detection stage Haar Cascaded and deep learning were used and tested using both CPU and GPU as backend. Results show that the designed model run time to recognize a face sign is 0.44 seconds. Besides, the average test accuracy has been increased from 64% for the original FER2013 dataset to 91.76% for the modified balanced version using the same transfer learning model.