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SKETCH-VERSE: Sketch Image Inversion using DCNN

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Abstract – *The proposed work uses Deep Convolutional Neural Networks (DCNN) for converting face sketch images to photorealistic images. It first constructs a semi simulated dataset by preprocessing the images in the dataset. It is then undergone to the training process and model is generated. Recent advances in deep learning such as deep residual learning, perceptual losses, batch normalization and stochastic optimization are done in combination with the dataset. Finally it demonstrate the applications of the models in fine arts and forensic arts.*

Key Words: deep convolutional neural networks, stochastic optimization, deep residual learning, batch normalisation, perceptual loss.

1. INTRODUCTION

Facial identification is one of the crucial issues in today's world especially for law enforcement. They can use potentially use this application or they can use this technology for identifying the suspects and missing people. Mostly the sketches of the suspects are drawn by the artists based on the information given by the eyewitness to recognize and identify the suspects. But it is more difficult to handle and identify the suspects with their face sketches.

The proposed sketch inversion system will easily convert the face sketch image into photorealistic image in a single button click. It will be more comfortable and easier, if the photorealistic image of suspect is got. The input to the system will be a face sketch and after some preprocessing and matching steps, it will produce a photorealistic image as the output.

2. METHODOLOGY

The dataset used for converting sketch image into photorealistic image is retrieved from Multimedia Laboratory, which is a free repository which has the CUHK dataset. It is a large-scale collection of face images of both genders which have 17108 sketch images and corresponding photorealistic images. The system works in the following manner:

- Initially, the dataset is undergone some data preprocessing using data augmentation techniques.
- The dataset is prepared as a semi simulated one and is fed into the training algorithm.
- VGG-16 pre trained model is used for setting the initial parameters and the model for the system is created during the training process.
- Adam optimizer is used for generating the model.
- After generating the model, the testing process is done.
- Output is generated for various face images.

3. TECHNOLOGY STACK

3.1 Deep Learning

Deep learning is a subset of machine learning and it follows the machine learning strategy where the features are automatically extracted. It contains multiple hidden layers, hence different from traditional neural networks. The number of hidden layers will decide the optimality of the system.

The model architecture plays an important role in determining the feasibility of the system. We have developed a new model based on VGG 16 which is a deep learning algorithm.

3.2 Keras

Keras is python library open source neural network. It is a framework designed for machine learning. It is designed in such a way that to enable fast experimentation with deep neural networks, it focuses on being user-friendly, modular, and extensible. Deep learning models can be developed with keras and it will be easier us to develop the project.

3.3 OpenCV

It is an image processing tool used in the feature extraction of the images. In this paper the use of OpenCV is in displaying the sketch and the related phot realistic image. It is the best open source tool for image processing.

3.4 Bottle

Bottle is a python application development tool. This helps to develop interfaces for applications that looks like a User Interface. It is a WSGI compliant single source file. Bottle is distributed as a single file module and has no dependencies.

4. METHODOLOGY

The dataset used for converting sketch image into photorealistic image is retrieved from Multimedia Laboratory, which is a free repository which has the CUHK dataset. It is a large-scale collection of face images of both genders. The system works in the following manner:

4.1 Data Preprocessing

Data pre-processing is the initial step in this system. The whole dataset is to be prepared before the training process. This step contains different augmentation techniques applied to each image in the dataset which includes scaling, translation, rotation, shearing, blur, flip, colour, jittering/noise, etc. After these processes the image is resized into a dimension of 96X96 range.

4.2 Training

This system is based on the deep convolutional neural network. After the pre-processing step, the pre-processed image set is fed into the training algorithm and it will generate a model based on the information gathered from the training process. Here, we used the Adam optimizer to generate the model. Also, VGG-16 model is used as initial feature extractor in the convolutional layer. It is a pre-trained model and act as a fixed feature extractor. 50 iterations are done on the dataset to get the desired accuracy. But it will take a sufficiently large amount of time to complete an iteration. The system will work well if it have enough processing power and memory space.

4.3 Testing

In this step, testing process is done on sketch images and the output of this module is saved as a file. In testing, the system use the generated model and apply the sketch image and do some preprocessing steps and finally convert it into photo realistic image. For each 2 iterations a model is saved along with a set of parameters. So that we can select any of the model with different parameters for testing among them. The most efficient model is chosen for achieving more accurate output.

4.4 Web Interface

In order to make the proposed system user friendly, here we used Bottle framework along with web page is used to collect the user input. Users can access the application to get the photorealistic image by inputting the intended sketch image.

Fig -1: Initial Interface

Fig -2: Image is selected for conversion

Fig -3: output

5. RESULTS

The Sketch inversion system is based on DCNN works to convert sketch image into photorealistic image wherein we employed with deep neural network for the required output. The system uses the dataset CUHK which contains 17108 sketch images along with the corresponding photorealistic image for training. Once training was completed the system was evaluated with other test images. The system was evaluated with the respective algorithm where the conversion rate has been observed nearly 70 percentage.

During the implementation of the system, we initially worked with the dataset where the training process had some complications which lead to variation in accuracy. Training the dataset with sketch image and photo realistic image took considerably large amount of time span and it seems to train the system for at least 50 epochs which in turn need a lot of time. The system can be deliberately finished if sufficient training is done. The output is saved as a jpg. File which is displayed to the user in the mentioned interface.

Fig -5: Test case results

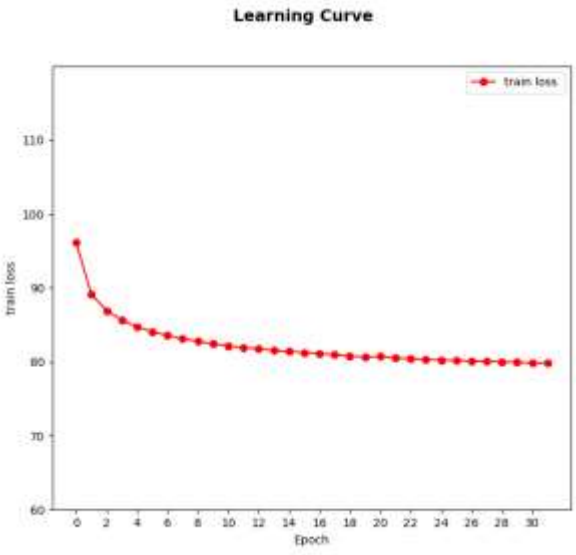

Fig -4: Learning curve

3. CONCLUSION

In this work, we developed a sketch Inversion System based on Deep Convolutional Neural Network (DCNN). The proposed method convert sketch images with many challenges. The robustness of the model could be improved using data augmentation techniques. Thus, the model work well for dataset under uncontrolled conditions such as variations in scale, position, rotation, shape and noise. In order to improve the functionality and flexibility, we created all real world challenges in the dataset. Experiments were conducted on the dataset and the results showed that the system has achieved desired accuracy rat. We hope the followed methods in this system will convey more reliable information than previous systems and inspire the future studies.

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