CS771 Project Proposal
Painting Classification Using Convolutional Neural Networks
Group-8

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September 2017

Abstract

Our project makes an effort to classify paintings on basis of their painters. This is to be achieved by using a Convolutional Neural Network which will try to learn the hidden artistic signatures in the paintings and hence, come up with a unique association between these signatures and the artists.

Introduction

Each day, a huge amount of data is uploaded on the internet for the world to view, amounting to nearly 50000GB/second[1]. A majority of this data is composed of images, which has to be stored with proper tags like artist, genre and other essential information. This calls for some automated mechanism to accurately tag these images since doing it manually may take decades, if not centuries.

Proposal

In this project, we try to develop a Convolutional Neural Network(CNN) model to accurately predict the artist of a given painting. We focus our attention to classifying paintings(painted by artists, not digital photographs) on the basis of their producers.

Dataset

- Kaggle dataset: This dataset contains a huge number of paintings with propel labels which is a huge bonus for us. However, the number of paintings per artist is quite low which will lead to inaccurate predictions by our model. We will have to filter out the artists who showcase the maximum number of paintings from this huge dataset.

- Web Gallery of Art(WGA): *"The Web Gallery of Art is a virtual museum and searchable database of European fine arts from the 8th to 19th centuries."* This dataset contains a huge number of images labelled in terms of artists, year, genre and location. The same task of filtering out artists with sufficient number of paintings needs to be carried out here too.

The first dataset is available to download for free, whereas the second dataset requires building of a web scrapping script to extract the data.

Problem Statement

The problem statement is formally stated below:
"Given a painting by an unknown artist, predict the artist who is most likely to have produced the artwork."
Basically, this reduces into a multi-classification problem, where the output gives the probability of a person being the true producer of the painting. The artist with highest probability is declared as the painter of the art. Using the CNN model, we hope to learn about the presence of any *artistic signature* which distinctly identifies the works of a given artist.

We decided to use CNNs since it has proved to be very accurate and efficient for image classification problems.

Probable Course of Action:

- **Data Augmentation:** Firstly, Data collection from the aforementioned sources and normalise the images to 256 x 256 size. If required we may have to decrease resolutions.

- Select painters(Number of classes) to start our classification and get training and test data accordingly.

- **Model Details:** Completely construct the details of the model and algorithm we will be using to classify the paitings.

- **Implementation:** Coding and training the ML model to predict the class of a given image and then trying to improve accuracy.

Further ideas depending on time:

After the primary classification is done, we would like to test if we can extend the model such that, "Given any two paintings the model will predict whether they are works of the same painter or not".

We can also try to train the model to detect paintings from painters it has never seen before. Finally we will try to look into painting generation, given a painter . Although these ideas may not be possible to complete because of timeframe(and resource) constraints, we are definitely looking to learn a lot from these explorations.

Resources

Image extraction using CNNs involves a huge number of matrix calculations, mostly multiplications, which can be carried out in parallel. Hence, it is more beneficiary to use GPUs instead of CPUs, since GPUs have much greater number of cores than CPU which promotes parallel operations.

The CSE department of IIT Kanpur offers 10GB of space and very well equipped GPU servers, which can be used by us for the purpose of training our model.

Previous Work

Multiple papers have been published regarding feature extraction from paintings on basis of color texture, brush strokes, etc.[2, 3] There also have been researchs on developing models with low amount of data based on semi-supervised approach.[4] The problem statement was selected by us as a variation of the original problem at: Painter By Numbers[5]

The proposed problem is a little less complicated than the original one mentioned above, owing to the limited amount of time we have to learn and implement the proper CNN algorithm. We strive to make efforts to bring improvements in best accuracies acheived till date by suitable choice of feature sets.

Please refer to the references section for a complete list of references.

References

[1] Internet data usage statistics: `A Blog on Corporate News`

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[4] David, Eli & Netanyahu, Nathan. *DeepPainter: Painter Classification Using Deep Convolutional Autoencoders.* 20-28. 10.1007/978-3-319-44781-0_3. (2016)

[5] Kaggle Challenge: Painter By Numbers

[6] Stanford University CS231b project: Understanding Visual Art with CNNs

[7] Stanford University CS231b project: Using Convolutional Neural Networks to demystify aesthetic works of art