Understanding Google's Deep Dream

Exposé for Machine Learning Project

Team:
Victor Münch (561484)
Martin Gladigau (561290)

Introduction

We want to understand how Google's Deep Dream algorithm works. The algorithm uses a convolutional neural network. The technology behind it fascinates us, since a neural network is not only used to classify data, but also to manipulate it in a way that could otherwise only be performed by well-trained artists. Although it only shuffles numbers, it seems to generate what humans perceive as art.
Looking at the technology in this way might also increase our understanding of how a trained neural net works on the inside.

Project Objective

The process works generally like this: An already trained network that can classify images is used to change the inputs of an image to increase the value of certain neurons. Those neurons are chosen by determining which neurons have high values when classifying a second image whose style is to be imitated. If neurons in higher layer neurons are used, more complex structures arise (e.g. a cat face); if instead lower layer neurons are used, less complex structures arise (e.g. fur-like surfaces).
The first objective is to understand how the Caffe framework is used implement this process.
We will then attempt to reimplement it using Tensorflow 2.0 instead of Caffe. We will use an already trained network and focus on the objective to manipulate the input data.

Learning Objectives

We want to familiarize ourselves with both the Caffe and Tensorflow 2.0 frameworks.
We want to understand if and if yes, how it is possile to increase the values of certain neurons by changing the inputs using Tensorflow.
Visualizing what happens when certain neurons are enhanced may also shed some light on the black box of a classifying neural net. One might get an insight to which neurons in which layers might be representing what kinds of features.

Timetable

We have 6 weeks to finish the project and one more week to prepare the presentation.

- Week 1: Be able to use the existing code locally to generate images. Get an overview of the project.
- Week 2-3: We split up: One person gets a deeper understanding of the existing Deep Dream Code (thereby getting to know Caffe), the other familiarizes himself with the Tensorflow 2.0 framework.
- Week 4-5: Implement the algorithm in Tensorflow
- Week 6: Clean up the code and finish the documentation
- Week 7: Prepare the presentation