Marc Laugharn
MATH189 - Math of Big Data
Project Proposal

Summary: I want my midterm project to be participation in the following Kaggle competition using anisotropic kernels to determine visual glitches faces in video frames in forged videos.

Deepfake detection challenge https://www.kaggle.com/c/deepfake-detection-challenge/

Data: 470 GB of video files, with the label 'fake' or 'real'

Method:

- Extract all frames from videos

- Extract all faces from frames using MTCNN or similar face detection model

- Create embedding vectors per face per frame

- Given point clouds consisting of embedding vectors, calculate prob(video is fake — face embedding vectors, trained weights)

  I want to calculate this probability using the maximum mean discrepancy metric and some kernels that rescale the data according to local covariance of the data (i.e., create basis functions that are shaped according to provided data, rather than e.g. Gaussian balls)

Inspired by:

Two-sample Statistics Based on Anisotropic Kernels https://arxiv.org/abs/1709.05006

A witness function based construction of discriminative models using Hermite polynomials https://arxiv.org/abs/1901.02975

Evaluation metric: log loss of predictions

Possible challenges:

- Model must run in $< 9$ hours on Kaggle hardware

- Face detection models typically are not trained on fake faces, so might misbehave

- Videos may contain multiple faces

- Part of the challenge is detecting forged voices also, so I must find a way to incorporate that information as well

∎