# Group meeting 1

* We want to combine different components in a new way instead of building a new layer theoretically
* Another idea: building on top of existing networks (such as XceptionNet)
* We don’t want to go too deep theoretically and need to start coding
* Aim: to get some model going using the code from chapter 5 modifying for deepfakes
* Next time: set an agenda for the meeting
* Data preprocessing: could look into Kaggle and use their preprocessed data to start with
* Starting only with images, later potentially look at videos (multiple frames, 5D tensors) – a question for Yorgos
* Need a preprocessed dataset from Yorgos to build a model, simultaneously preprocess

Suggestions for capstone:

1. A network that would work well with deepfakes but generalizes well to other GANs (deepfakes only dataset) or NeuralTextures?

2. Experiment with different variations of features (groups, activation functions)

3. Experiment with fakeness of the dataset increasing difficulty (test whether focusing on the low-level subtleties improves performance)

*4.* Check ‘*A Deep Learning Approach To Universal Image Manipulation Detection Using A New Convolutional Layer’* paper if we could impose similar first layer (the new *contribution)*

*5.* *‘Distinguishing Computer Graphics from Natural Images Using Convolution Neural Networks’* paper: splitting an image into different frames to gain certainty about fakeness of the image

*6.* Xception: Apply a 1x1 convolutional layer and then experiment with a range of 3x3 convolutions

To discuss with Yorgos:

1. Preprocessed data set

2. How often can we train a NN? Experimenting with parameters such as number of groups, layers, activation functions etc.

3. Increasing difficulty of the dataset (not relevant anymore now)?

4. Is using just a green channel enough?

5. Videos vs images

6. Kaggle

7. Using pre-trained models

Next steps:

* Meeting with Kostas and Yorgos
* Next group meeting: Friday 12pm
* Pick a new paper each
* Reread summaries individually
* Kat: chapter 5, digitize notes
* Create and develop a doc for particular network features
* Register on Kaggle (read through two notebooks each)
* Register for deeptrace updates
* Schedule a meeting to code together

# Group meeting 2

Agenda:

1. Progress periods (exams)
2. Results of meeting with Kostas and Yorgos

* Decision: Greg is working on the architecture, Kat and Laurens are working on the pre-processing
* Greg presented DenseNets
* Generalizing CNN surprising easy to use -- read on the data augmentation
* Kat: <https://machinelearningmastery.com/best-practices-for-preparing-and-augmenting-image-data-for-convolutional-neural-networks/> -- website overviewing image data for CNNs

Do:

* All read the ResNet paper (Greg will do the summary)
* Greg: summary of DenseNets
* K: Generalizing CNN surprising easy to use -- read on the data augmentation
* K&L: Crop out only relevant parts of video using the mask.
* FFmpeg, figure out how it works (K&L)
* Request resources via LSE (K&L)
* Write a quick report on both possible datasets (could be constrained by capacity) possibly consider the GAN dataset sent by Yorgos last meeting
* Search data-loaders on the internet, should be able to find them

# Group meeting 3 (K&L)

Accomplished:

* Making a “Loading pre-processing” file containg Kat’s work on ffmpeg, image pre-processing (train and test time augmentation for best-performing CNNs)
* Established choice of dataset, first working on FF++ (to be discussed monday)
* Difference FF++ and DFD: test set of former consists of images, latter of videos (extra work)
* Figured out how to download the relevant data from FF++
* Figured out how to extract frames from videos with ffmpeg and py-file from GitHub

Do:

* Use Thies et al. to extract square faces from videos (1.3x crop as used by FF++ paper)
* Figure out how to use Keras (ImageDataGenerator class) for image preprocessing
* Run through some Kaggle notebooks

# Group Meeting 4

Agenda:

1. Greg update
2. Kat/Laurens update
3. Schedule meeting Yorgos/Kostas and what to discuss there
4. Next steps - potentially start write-up while simultaneously coding. Let’s get a LaTeX collaborative doc going

* We have learnt how to extract frames (all for now but we will learn rates) from a video
* Video handling is done by RNNs, could incorporate later after the network is built to handle frames
* Choice between kaggle and faceforensics++ datasets

Previous work:

* We know how to download faceforensics++ videos to local storage
* For each original video we get 4 manipulated videos (by each out of 4 methods)
* openCV package for cropping frames into squares
* Done some research on train-time augmentation
* Looked into ImageDataGenberator
* Greg has used keras for CIFAR10 datset to build some models
* Feature extraction and fine-tuning: experimented on VGG and ResNet
* A way to save weights (everything on google drive)

Other ideas:

* Later we can mix and match which method(s) to use to get the best test accuracy
* Next, Laurens will upload his script to github
* Another point: get a function to read the image into tensor
* In future we need to make a distinction between training, validation and test data
* Potentially get more space on google drive and extra GPUs
* Could look into getting Colab Pro
* We need to reproduce XceptionNet from faceforensics++
* Learn functional APIs?

Next steps:

* Laurens will work on openCV
* Kat will pre-process the cropped frames and turn them into tensors + normalisation + funding proposal
* Greg will document his work on networks
* Check not to use github at the meeting
* Kat will set up Overleaf
* Set up meeting with Yorgos (thursday 10-11 or wednesday 1-2)

# Group meeting 5 (K&L)

* Discussed resizing included in facecropper\_script.py; we want the largest possible size (to prevent loss of information, constraint to original size of the faces in the videos and storage), ideally, we don’t crop in the .py and resize once we load data (prevents reloading data constantly)
* For now, we are going with the naive approach of getting a prediction per frame (independent of other frames from a given video and their sequence) and then add an extra step after running the network to compare individual predictions and average (or any other prefered manipulation) per video
* If we want to improve on performance of video classification we have to be looking into establishing RNNs and multi instance learning with set functions

->

We should be researching more into methods that do not throw away information about time and grouping of the frames (apparently there is a recent publication that might be relevant)

* We should be storing cropped faces (per video as coded by Laurens) in a shared google drive to prevent having different datasets separated on individual local storages

-> we have to look into buying more storage in Drive (loading from drive is done by Kat)

Next steps:

1. Schedule a meeting with Yorgos and Kostas (update on current state and insight about potential development into multi instance learning)
2. Get the paper on multi instance learning (Kat)
3. Look into storing cropped faces in a shared google drive
4. Kat will upload her current code
5. Greg will create a review on his work
6. Code should be transferred to GitHub for easier collaboration
7. Schedule next group meeting

# Group Meeting 6

Agenda:

1. Storing cropped faces in google drive (buying storage)
2. Using GCP to store cropped faces in a shared bucket vs storing the cropped faces on Google Drive (more compatible with Colab)
3. Cropping frames without resizing (upgraded method)
4. Re-downloading all videos uncompressed
5. Tackling cropped faces that are false
6. GCP (AI Platform) vs Colab, Google Drive vs Buckets (potentially a topic for the following meeting)
7. Schedule a meeting with advisors
8. Discuss presentation on Zoom Friday
9. Next steps, redistribute the work

* No compression for training, for testing use all three types compression types
* GCP as tool to eand then store on Google Drive
* Can use Kat’s laptop instead of GCP, but might be easier to upload images from GCP to google drive
* Buy GD pro, will see the size on GCP first
* Kat is family with da boys <3 <3
* Improved cropping to be squares, upload later
* Tackling cropped faces that are false: rerunning the same algorithm on cropped faces (input has changed slightly?), other algorithms?

Let’s pause this for now, then fix all problems before second transfer (depending on the GCP speed)

* AI platform vs Colab pro, AI platform is much faster but code in parallel and have data in buckets
* Data augmentation is not implemented yet.

Next steps:

* Next week monday -- meeting with advisors (email to Yorgos and Kostas by Laurens)
* Greg and Kat and Laurens!!! -- update on code (11 am)
* Laurens makes powerpoint, structure made by Laurens, shared tomorrow

Distribution of work from now on:

figuring out how to use RNNs to process videos instead of frames

Kat: GCP and GD

Laurens: RNN

Greg: CNN architecture continued

# Group Meeting 7

* Face cropping algorithm (got a keras from Yorgos, Laurens used more)
* Extra google drive storage (kat)
* Speak to kostas and yorgos about the first draft
* Plan: decrease the workload while completing final projects, increase workload while studying for exams, put full effort after exams
* Progress with first model: original images and missing last step to get prediction per video
* proposal for funding for Kostas
* Colab pro as a back up

From now on:

* Write proposal (Kat and Greg)
* Ask about report draft (Kat)
* Skype with advisers: schedule asap: ask Yorgos for calculation
* New cropping algorithm (Laurens)

# Group Meeting 8

Discussed in requirements for the first draft and update for the advisers

Tasks:

Kat: will write literature review, data and research problem (including Deeptrace and relevance) sections

Greg: will write up his progress on networks up to this point, including what was investigated and what other possible directions can be explored (½ of the update for advisers)

Laurens: will write up his progress on cropping algorithm, including what things will be modified (½ of the update for advisers)

Next steps:

Sky next weekend when the parts are written

Greg will email Yorgos to refine the pricing calculations for the funding proposal

# Group Meeting 9

* Discussed the first draft and update written for this week
* All the comments are online and will be implemented in Latex
* Everything will be put together in one doc and emailed to advisers on tuesday morning
* Laurens has updated others on the results of Kaggle’s deepfake challenge, main points are:

1. Accuracies are low, around 70%, a lot of opportunity to score higher
2. Dataset must have been more challenging
3. The best-scoring methods were using scaling factor of 1.5-1.7 (bounding box algorithm)
4. A lot and various augmentation has been crucial for achieving good results
5. None of the best-scoring models have utilised RNNs, doesn’t mean they are definitely not useful, but at this moment looks more unlikely than likely that RNNs will increase our test accuracy -- the group has decided to still experiment with the set up

Overall points and tasks:

* Links to the useful resources should be published in “Random ideas” doc with a short explanation of how they might be used -- this should be done to build up the materials for lit review and so that everyone has fast access to everything
* Kat will look at the new bounding box algorithm which Laurens has suggested (link provided in group chat), if implemented successfully, will move all the images to google drive
* Email advisers with the write up + report (cc Milan in)
* Group skype next week to get up to date

# Group Meeting 10

Discuss regarding cropping options:

* scaling factor -- 1.6 with longer side
* threshold probability values, maybe pick a face with higher probability?

Get the bigger faces, one face per frame

Threshold probability 80%

Identify images with bigger bounding box but smaller probability

* sometimes there is an error with cropping because an image is too close to the border for a given scaling factor, options: to reduce the scaling factor or shift the box

Shift the box

* for scaling, shortest or longest side? Longest

Laurens: email!!!

Greg and Laurens: tell Kat if change decisions

Kat:

1. read second and third places in Kaggle competition before finalising

2. upload .py to Github

3. Write up instructions on preprocessing google doc

4. Upload images to google drive

# Group Meeting 11

Agenda:

* Organise presentation on 15th (split the work: recap, update on pre-processing, update on obtaining grant (overview of how we are going to manage computational tasks), preliminary results for accuracy, main focus)
* Organise call with the advisors and email them a general update on pre-processing
* Choose the main focus for the report
* Split tasks for the next two weeks:

1. **Clean up the report (splitting into chapters etc)**
2. Prepare presentation
3. updating report: computational resources in methodology, main goals in the introduction and later section, pre-processing (downloading videos, extracting frames and cropping faces), literature review on cropping method
4. Running latest network to obtain baseline results for the video accuracy on all 5 methods (with balancing classes and augmentation)
5. Exploring RNNs or any other developments

Agreed during meeting:

* 6 hours 5 days a week
* Skype call every 3 days (Mondays, Thursdays) 9 am

Discussion on main research problem:

Potential aims:

1. To experiment with how training on data generated on one GAN generalises to

other manipulating and generating techniques

2. To compare and contrast effectiveness of deepfake detection on videos of various

compression and quality

3. To incorporate RNNs to retain some of the important information which is lost

when a video’s frames are evaluated separately (view frames as an ordered collection)

and compare this method with original method of testing frames separately to predict

if a video is fake to conclude whether patterns and time can add value to the detection

methods

4. # To explore light-weight network structures to build a light-weight network with

high detection accuracy

5. Idea: extract cropped images into multiple parts

All agreed on:

* Experiment with multiple structures to propose a new feature, train and test on all methods (highest available quality), later with the best model test if generalises well on multiple methods if trained on one
* Lightweight networks are not included at this point in time

Tasks:

* Laurens: presentation -- preliminary results and main focus; report -- clean up, literature review for retinaface, extracting frames; send the link for reading materials
* Greg: presentation -- google grant; report -- resources section, downloading videos, modify Xception net and add Kat’s parts
* Kat: presentation -- recap, preprocessing; report -- retinaface cropper, upload code to github, move data to GCP and make sure guys have access to it on drive
* For everyone: read the most recent papers to get an idea of the latest developments

Next call on Thursday 9 am

# Group Meeting 12

Updates:

1. Laurens -- cleaned up Latex (including citations), reread papers to see if we were missing it, Bag of Tricks paper wasn’t super relevant, restructured google drive, organised literature section, read three assigned papers (Bag of Tricks, Optical flow (not worth it), Simple features (interesting method without cnn, svm based -- we could take it on top of the cnn)), looked into AI platform (look into it vs clusters)
2. Greg -- understood Kat’s code and implemented networks, read the paper on RNN (very good paper, we should try, + might pick up what our current method will miss because frequently only 3 out of 10 seconds are manipulated), waiting to put in the preliminary results into the presentation
3. Kat -- organised all the data on google drive and in a GCP bucket (pre-processing stage is hence complete), presentation complete, report part written, read papers (good small ideas but overall not necessarily applicable, maybe incorporate masks from multitask learning papers)

Discussion:

* Capstone project is not research paper, hence we can include preliminary results
* Preliminary results on FaceForesnics++ -- let’s include it as our first test: running all networks (including efficientNet)
* In addition, if any frames are duplicated then likely to be manipulated (idea from RNN, digital media forensics method, old school and outdated)
* We should be implementing as we go
* Take a collection of models and use them together to produce the final classification -- improves robustness
* Taking a top third of frames’ probabilities to average for an overall video prediction -- will make the algorithm more robust and sort out the problem where only parts of the videos were manipulated

To do:

1. Greg: write a paragraph for report on computational resources (google colab insufficient, obtained a grant, shared project, AI platform), look into AI Platform to set up Notebook Instance, summaries
2. Laurens: summaries, report, presentation, build svm to join with a cnn
3. Kat: upload my part to Latex, make my code user-friendly, prepare it to be run on GCP with all our networks

# Group Meeting 13 (15/06)

* Presentation sorted (move slide 9 to slide 3, slides are split)
* Save data as 5 different .npy arrays (one per method)
* Discussed literature review -- split by different topics, add relevant things
* Discussed other datasets: Kaggle dataset is too big (could take a sample), could do FaceForensics++ with one image identified as one video (will look into more datasets later once models are running)
* So far not adding any more training data, will make this decisions later
* efficientnet -- potentially pretrained on deepfakes dataset

Updates:

Greg: figured out AI platform, worry: notebook instances are not optimised for training -- solution: fuse buckets, worked on tensors

Laurens: did simple features code (implemented but have not tested, then found github code), looked into datasets we can use for testing (aiming for different compressions)

Kat: cleaned up the code, added a feature to pick what fraction of top-frames to consider for a video’s accuracy, added more options, added loading and saving methods for arrays, started working on an EfficientNet

Tasks:

* Everyone: read the last paper that Laurens has sent
* Laurens: fix presentation, look into EfficientNet (switching to functional API) + simple features
* Kat: will design the tensors’ structure and sort them out locally, go over the report (guy’s parts) + work on organising and writing more for literature review and data sections
* Greg: continuing to set up AI platform? [I completely forgot what he picked]

# Group Meeting 14 (18/06)

Agenda:

* Meeting with advisors
* Updates
* Report style (present/past? inconsistency)
* Report style (referencing section - put a table in front?)
* Focus on report write-up (bulk of marks - more details in Capstone doc)

Updates:

Kat: finished data for the bucket (will upload to the drive), read the report, read githubs for winners, read the mixup

Laurens: presentation, read Kaggle, working on functional API

Greg: read submissions, fixed introduction for report

Discussion:

* Need to reach out to advisors
* Try preprocessing on top of current cropped images
* Report style -- present and refer Section [methodology] etc
* Change references to harvard style

Tasks:

Laurens: efficentNet set up + will look into another thing to implement

Greg: test arrays on AI platform (running 25\_May), connect AI platform to github, clean up 25\_May

Kat: Preprocess benchmark, look into train time augmentation from winning Kaggle submission, email advisers early next week to schedule for the week after