

# Projects for Advanced Deep Network Development

## Project #1 – Digital Twin

Supervisor: Bruno Melício

Number of students required: 2

### Description

The Digital Twin project is an exciting opportunity to create a digital representation of yourself using advanced Deep Learning technologies. In this project, students will be given an input video (or set of images and audio) of a person and will use 3D face reconstruction methods to create a 3D model of the face with texture. Next, they will learn the voice of the person using voice cloning techniques. Finally, they will generate a talking face of the person that is driven by a new audio, using lip sync method. By the end of this project, students will have developed skills in deep learning, computer vision and speech analysis.

### Goals

To research the most recent methods on 3D Face Reconstruction, Voice Cloning and Lip syncing;

To learn the basics of 3D face reconstruction methods and techniques;

To understand how voice cloning works and how to apply it to create a digital voice;

To develop an understanding of lip sync methods and techniques;

To create a talking avatar of themselves or another person that looks and sounds like the original.

### Potential methods

3D Face Reconstruction:

- [https://github.com/cleardusk/3DDFA\\_V2](https://github.com/cleardusk/3DDFA_V2)
- [https://github.com/sicxu/Deep3DFaceRecon\\_pytorch](https://github.com/sicxu/Deep3DFaceRecon_pytorch)

Voice cloning

- <https://github.com/CorentinJ/Real-Time-Voice-Cloning>
- <https://github.com/coqui-ai/TTS>
- <https://github.com/PaddlePaddle/PaddleSpeech>

Lip syncing

- <https://github.com/Rudrabha/Wav2Lip>

Note: Additional technologies might be needed to map the facial expressions, sync and animate the generated face

## Project #2 – Football Insights

Supervisor: Bruno Melício

Number of students required: 2

### Description

The Football Insights project is an exciting opportunity to analyze football matches and generate statistics using state-of-the-art computer vision techniques. In this project, students will detect and track the ball and football players using object detection and tracking or optical flow methods. They will also estimate the body pose of the players and analyze the movement of their body parts. By extracting these features, students will generate statistics about the match such as the number of times the ball was touched, the player with most touches, the player with most passes and shots, and more. This project will provide hands-on experience in computer vision, data analysis, and deep learning.

### Goals

To research the most recent methods in object detection, tracking and optical flow;

To learn about object detection and tracking methods used in computer vision.

To learn about object detection and optical flow methods used in computer vision

To learn about 3D body pose estimation methods

To develop skills in data analysis and visualization.

To generate meaningful statistics about football matches using the extracted features.

### Potential methods

#### Object Detection

- <https://github.com/WongKinYiu/yolov7>

#### Tracking

- <https://github.com/ifzhang/ByteTrack>

#### Optical Flow

- <https://github.com/autonomousvision/unimatch>

#### 3D Body Pose estimation

- <https://github.com/isarandi/metrabs>
- <https://github.com/google/mediapipe>

Note: Additional methods might be required for the analysis. Most likely a rule based system will be used.