How to run

1. **Recognize\_points.py** in the *Preparation* folder reads in the images that are in *FRS/with\_points* and *in FRS/without\_points*. The program automatically recognises the marked reference points and saves all coordinates and the original image in the folders *1\_Coordinates\_For\_Image* and *1\_Images\_Without.*
2. The training and testing procedures are done for each point individually, so there is a separate folder for each cephalometric landmark. Each folder contains a script **extract\_point.py** extracting the specific point from all coordinates (this requires a complex algorithm and must be done differently for each point). The coordinates of this point are then saved in *../../CNN/S\_Point/Coordinates*. The images with and without points are also saved in *../../CNN/S\_Point/Images\_with and ../../CNN/S\_Point/Images\_without.*
3. The *CNN* folder contains all the files needed to train and test the model. **Train\_CNN.py** is used for training and the trained CNN is saved for each point in the corresponding folder.
4. **Recognize\_Image.**py uses the trained model to recognise the cephalometric points.
5. **Evaluate\_Recognize\_Image.py** applies the trained neural network to detect the cephalometric points on the images and then stores the mean radial error, the error along the X-axis (∆x) and correspondingly the error along the Y-axis (∆y) in txt files located in *../../CNN/Test\_Data/External\_Validation*
6. In order to run **Evaluate\_Recognize\_Image.py**, the folders for each point in *../../CNN/Test\_Data/External\_Validation/S\_Point\_Coordinates* and *.../External\_Validation/S\_Point\_images\_without* must be prepared manually.