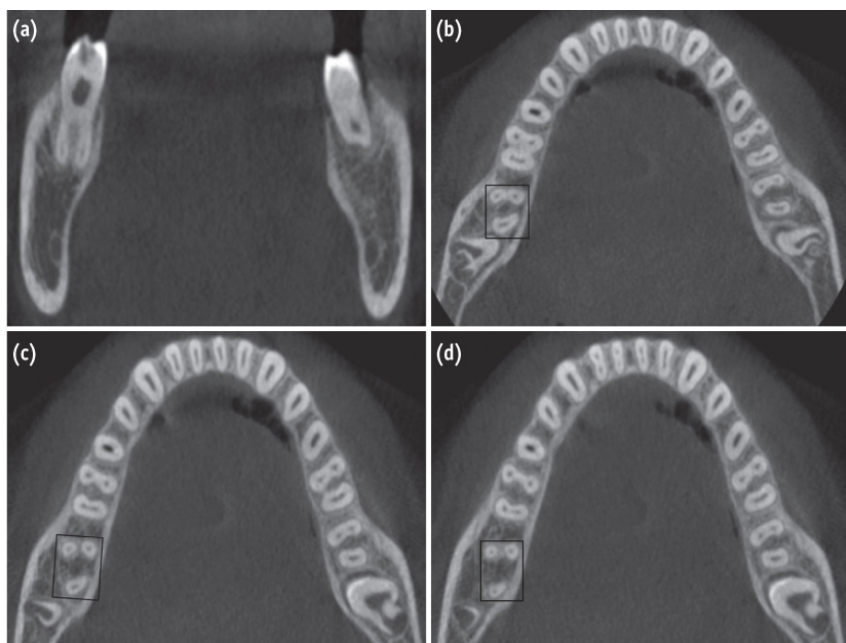


Segmentation of tooth roots in CT Scans

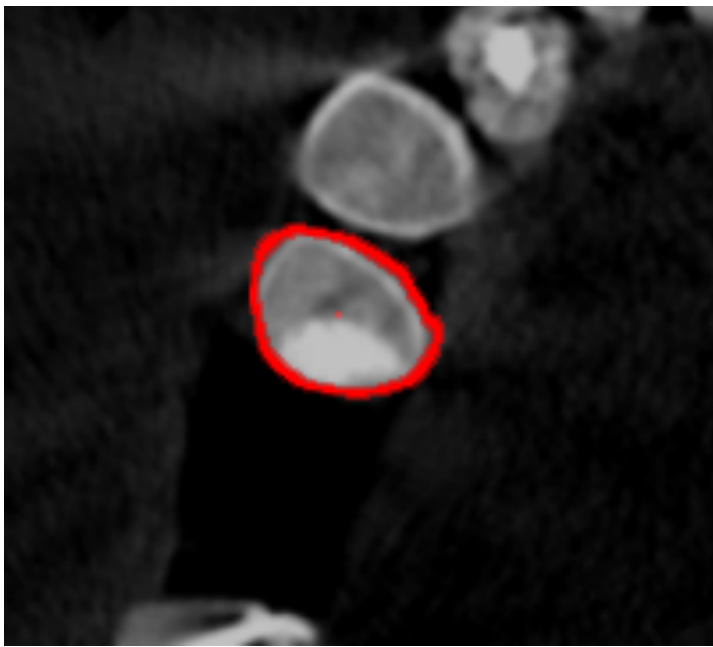
Mathias Brännström

X-Rays are commonly used in medicine to help diagnosis and procedure planning. Particularly, in dentistry, a technique called [cone beam computed tomography](#) (or CBCT) is used.

A CBCT scan creates a 3D reconstruction of the head that can be in the form of so called [CT images](#) that looks like the images below. These images can be seen as slices of the object that has been scanned. Also, how white the image is depends on the density of the material scanned. The goal of this project has been to find where all the teeth are in these images and segment them from the rest of the data. We then want to create 3D models from these segmentations afterwards.

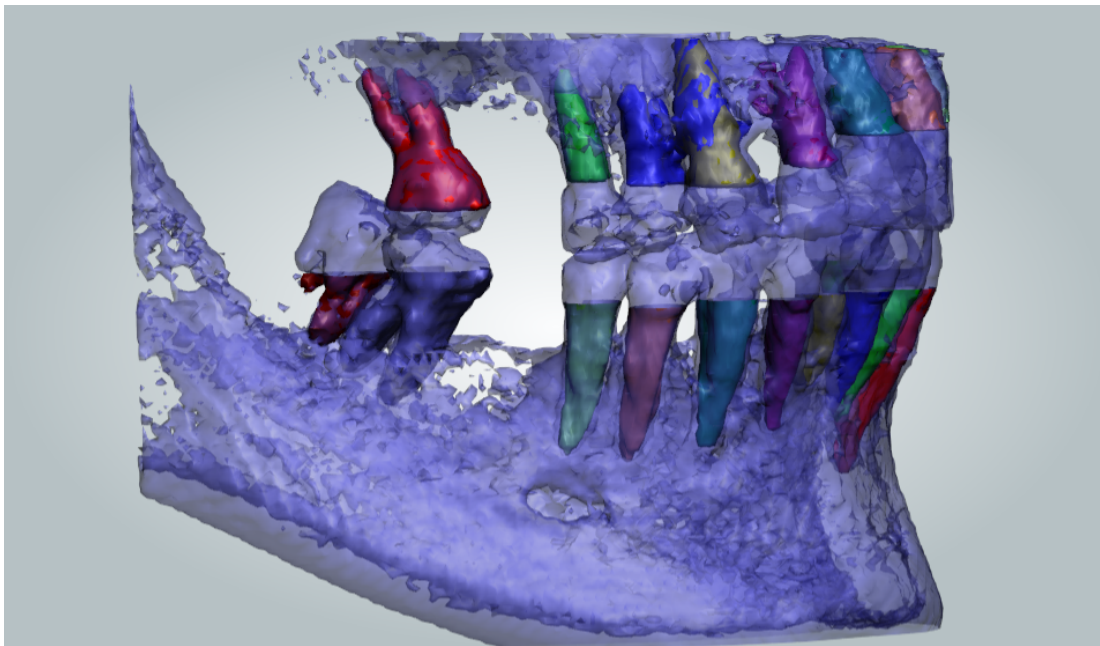


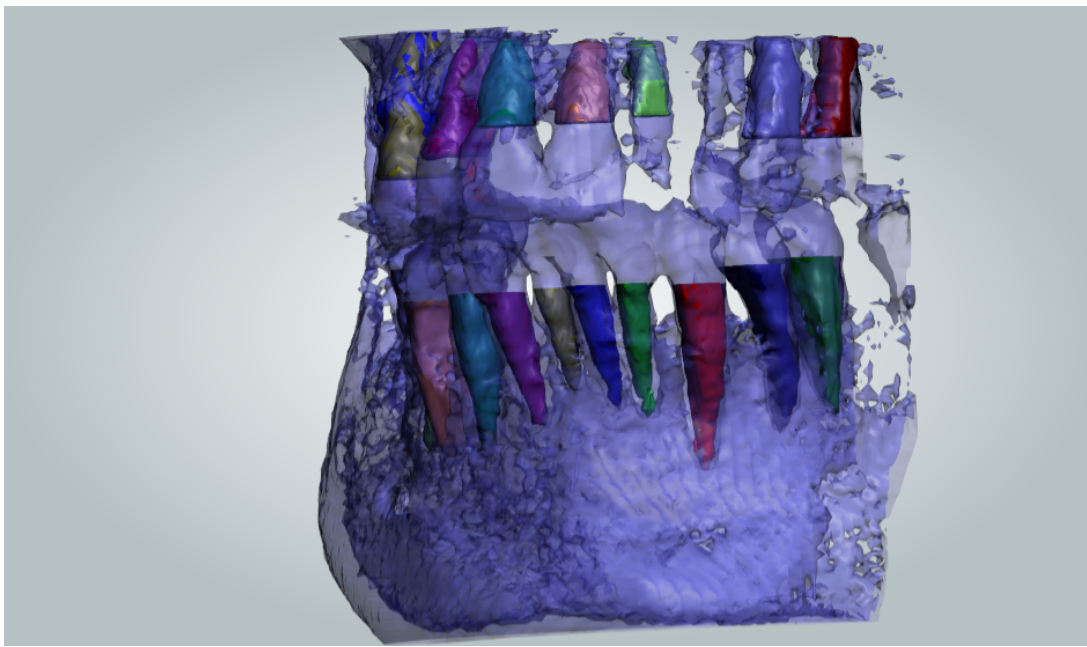
To find the teeth in the images we are using an already established method called the [Level Set Method](#). The advantages of this method is that it is very flexible and can be adjusted to suit our needs quite easily and that it is good for segmenting objects that splits somewhere. The teeth often does this since they often have multiple roots. This method then segment one tooth at a time by finding a contour of the tooth in each of these CT images. This could look like the figure below.



After finding contours like these in every CT image and for every tooth there is another method called [Marching Cubes](#) to create 3D models of the teeth.

The images below show what these 3D models look like on top of a blue transparent 3D model of the whole data set. The teeth look cut off because we have only segmented the tooth roots and not the tooth crowns.





The results are mostly good but there are some problems that needs to be solved. As can be seen in the images aboce the blue and the yellow tooth in the upper jaw has leaked into eachother. This problems are caused by teeth that are very close together. There is also few more data sets that was segmented where other problems encountered was caused by things such as the nerve canal in the teeth or data sets where the patient has metal in his or her teeth causing a lot of artefacts in the data. There are some possible solutions to all these problems but because of time limitations this was never tried or implemented.

To conclude this project I think that a method based on the level set method is suitable for segmenting teeth in CT scans if the problems encountered are solved.