

The Needle Detection and Reconstruction Based on Convolutional Neural Network (CNN)

The deep learning research and application develop very fast in past few years. CNN is of one the most powerful tools for image recognition, which is used for lane detection for automated driving (shown as Fig. 1)[1].

For automatic operation of surgery, the needle detection and reconstruction is the key challenge to realize for the first step. In the eye surgery, surgeons use a needle with diameter below 0.3 mm to inject into the eye and deliver some drug into vessel on the retina.

Currently, OCT image technology is only available approach to obtain 3D image of needle with ideal resolution. One slice of OCT image (with needle and retina surface) is shown in Fig.2. The complicated environment and high safety demand require a robust algorithm to model the 3D needle (as shown in Fig.3).

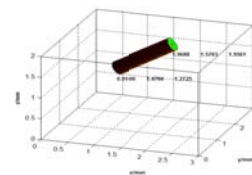
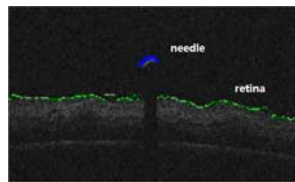


Fig. 1.CNN for lane detection Fig. 2. One slice of OCT image Fig.3. 3D needle reconsonction

The project will include following phases:

1. Learn basic principles of OCT image technology
2. Learn the CNN package: PDNN (recommend one).
3. Abstract a solution for needle reconstruction using OCT image
4. Write and conclude the results.

This is a very interesting project, while independent research quality is necessary. We require the candidate having basic knowledge of image processing and good math background.

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[1] Bojarski M, Del Testa D, Dworakowski D, et al. End to End Learning for Self-Driving Cars[J]. arXiv preprint arXiv:1604.07316, 2016.