Automatic assessment of time-lapse OCT for dosimetry control of selective retina therapy

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Materials and Methods

1. Data acquisition setup

SRT: frequency-doubled Nd:YLF laser with pulse width of 250 ns, pulse repetition rate of 100 Hz for 30 pulse-trains
OCT: line scan frequency of 70 kHz, spectral bandwidth of 170 nm centered at 830 nm.

The two beams are aligned through an SDO and targeted to the retina.
The resulting image is a depth profile of the treatment spot over time (an A-scan per time point).

2. Data description

- 153 enucleated ex-vivo porcine data
- 14 human patient data

Mscan size: (400 × (~20K) px → divided into square blocks (400 × 400)

Block labelling:

\[ y_{mb} = \begin{cases} 0, & \text{no visible SRT laser effect in block} \\ 1, & \text{visible SRT laser effect in block} \end{cases} \]

3. Block classification

A convolutional neural network[1] is trained to classify the blocks, according to whether they contain a visible laser pulse or not.

Each block goes through multiple filtering stages, and a decision is made as to what class it belongs to.

The model is first trained on the porcine data, and tested on the human data.
Then, the model is trained on the porcine data, fine tuned with a part of the human data, and tested on the rest human data.

4. Conclusions

- Automatic identification of a laser effect on a short Mscan block
- Robust model, able to generalize from porcine to human data

The block level assessment can be used as a first step to evaluate SRT energy treatment, and therefore be part of a dosimetry control system. The porcine data can be used to enrich the model, since they are much easier to acquire.

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