Neural network to predict improvement following pars plana vitrectomy for epiretinal membrane peeling

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Nothing to declare

Purpose

- To develop a neural network to predict visual outcome after epiretinal membrane peeling surgery from preoperative risk factors and optical coherence tomography B-scans.

Methods

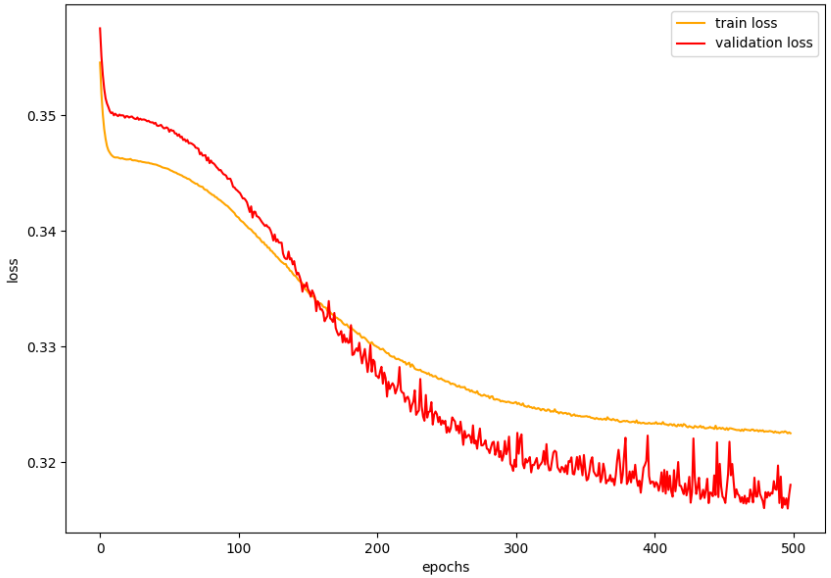
- Single center study
- 477 eyes of 473 patients with ERM at different stages were included.
- Surgery: pars plana vitrectomy with epiretinal membrane peeling and ILM-peeling with or without cataract surgery depending on lens status.
- A three-part neural network was developed and Images were processed in several previously published convolutional networks.
- A multilayer perceptron was trained on the seven clinical risk factors (lens status, visual acuity, etc.).
- Both networks were concatenated and again processed in a second multilayer perceptron.
- Labeling for supervised learning was decided whether an improvement of ≥ 2 lines logMAR was observed or not.
- The data set was divided into a test and a validation dataset.
- An additional independent test dataset was used to assess performance by measuring accuracy, specificity and sensitivity.

Results

- Using MobileNet as the convolutional part and images and clinical data together:
  - Accuracy: 0.69
  - Specificity: 0.58
  - Sensitivity: 0.82.
- Using clinical data alone:
  - Accuracy: 0.73
  - Specificity: 0.65
  - Sensitivity: 0.82

Conclusions

- With our deep learning based neural network we were able to predict correctly visual outcome improvement in about seven out of ten patients with a good sensitivity and a fair specificity.
- Future studies have to evaluate the clinical potential and increase accuracy with additional cases.



Left image: schematic illustration of the improvement of both training and validation models with regard to the epochs (epochs learning over time).

Right image: ROC curve from the test data set demonstratig the accuracy of the trained model.