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OPTIMA Ophthalmic Image Analysis

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Ability of eye-care professionals in grading retinal fluid volumes and change in age-related macular degeneration assessed by automated fluid monitoring

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Purpose:

- Flexible treatment regimens in neovascular age-related macular degeneration (nAMD) are largely based on the clinical assessement of intra- and subretinal fluid (IRF, SRF) on OCT images
- The goal of this study was to use an AI-based fluid algorithm to determine the **discriminative ability of eye-care professionals in grading intra- and subretinal fluid (IRF, SRF) presence and volume change** in real-world OCT images of patients with nAMD

Material:

- Included were **Spectralis SD-OCT scans** of two consecutive visits from nAMD patients from our retina department who had received one anti-VEGF injection between the two visits
- 5 **retina specialists** (RET), 3 **ophthalmology residents** (RES), 3 **general ophthalmologists** (GENO), 3 **orthoptists** (ORTH) and 3 **certified graders** from the Vienna Reading Center (VRC) graded the scans for
  - **IRF/SRF presence**
  - **IRF/SRF change**: increase / stable-no change / decrease
- The **Vienna Fluid Monitor** (RetInSight, Vienna, Austria) was applied to automatically segment and quantify IRF/SRF volumes and changes between visits
- In each group, the majority vote was used to calculate **sensitivity** (Sen) and **specificity** (Spe) of detecting fluid at each visit
- For **fluid change**, ROC curves were generated to determine volume cut-offs (nl) that provided the best trade-off between Sen and Spe (=Youden Index)

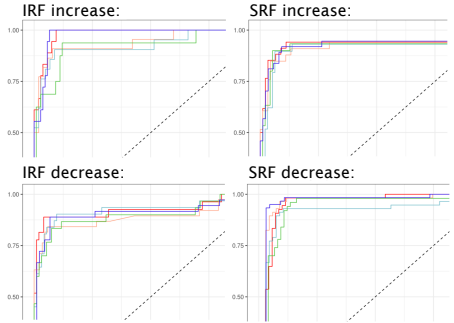

Figure 1: Receiver operating characteristic (ROC) curves showing the classification performance of each professional group in discriminating between eyes with IRF/SRF increase or decrease. Dashed lines indicate chance performance. The **AUC** was high with values consistently **over 0,89 across all groups and fluid changes**.

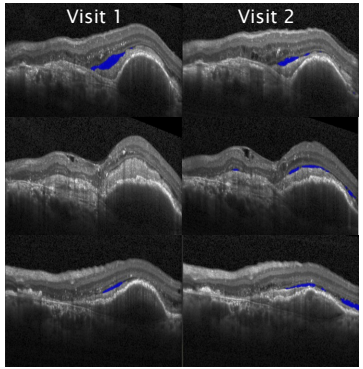

Figure 2: SD-OCT images of a patient show three b-scans at the same position, at visit 1 (first column) and visit 2 (second column). There was an SRF increase of approx. 100nl from visit 1 to visit 2, as quantified by the algorithm (blue segmentations). However, most graders indicated ‚SRF decrease'. This discrepancy might be due to the obvious reduction of a larger SRF pocket seen in the first row as well as an underestimation of multiple narrow and elongated SRF pockets at visit 2 (row 2 and 3).

Results:

- Included were 124 visit pairs of 59 eyes
- The ability to **detect IRF and SRF** appeared similar between groups, with an accuracy that depends on the chosen cut-off for fluid presence:

	IRF cut-off				**SRF** cut-off			
	1nl<		5nl<		1nl<		5nl<	
	Sen	Spe	Sen	Spe	Sen	Spe	Sen	Spe
RET	0,69	0,89	0,91	0,87	0,85	0,86	0,95	0,78
RES	0,70	0,89	0,95	0,88	0,82	0,93	0,94	0,87
GENO	0,69	0,87	0,91	0,84	0,78	0,93	0,89	0,88
ORTH	0,65	0,92	0,89	0,91	0,81	0,96	0,92	0,90
VRC	0,67	0,81	0,81	0,76	0,91	0,87	0,98	0,74

- Across all groups, there were no obvious differences in discriminating the **fluid change** between the two visits:

  IRF increases of 1,7-3nl were detected with Sen: 0,91-1,0 and Spe: 0,88-0,93

  IRF decreases of 2,8-16,9nl with Sen: 0,83-0,90 and Spe: 0,90-0,96

  SRF increases of 0,6-6,4nl with Sen: 0,84-0,94 and Spe: 0,89-0,96

  SRF decreases of 6,4-9,3nl with Sen: 0,93-0,98 and Spe: 0,87-0,95

Conclusion:

- AI-based fluid analysis permits to determine the accuracy of human experts from different professional backgrounds in grading retinal fluid types and their changes over time.
- The introduction of such objective, quantitative parameters results in a consistent and exact management, irrespective of the treating physicians' background.

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