MIC ID: RFP2

Financial Disclosures: The FILLY Phase 2 study was conducted by Apellis Pharmaceuticals and our work was in part supported by an Apellis research grant. The organization had no role in the design and conduct of this research.

Deep learning-based monitoring of Geographic Atrophy on OCT in the FILLY phase II clinical trial

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Objective

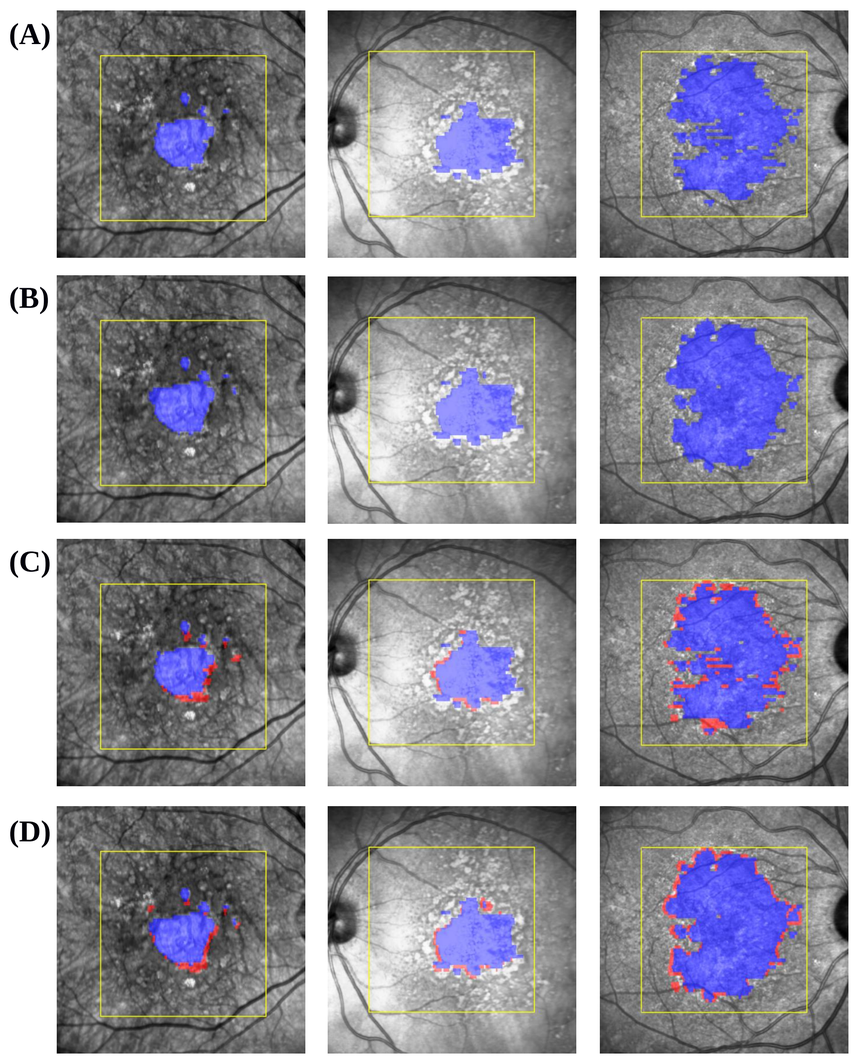
- To develop an **automated artificial intelligence (AI) algorithm** to **segment** and **measure geographic atrophy (GA) on optical coherence tomography (OCT)** scans, and to evaluate its potential for **AI-based monitoring of GA progression under complement inhibitory treatment**.

Methods

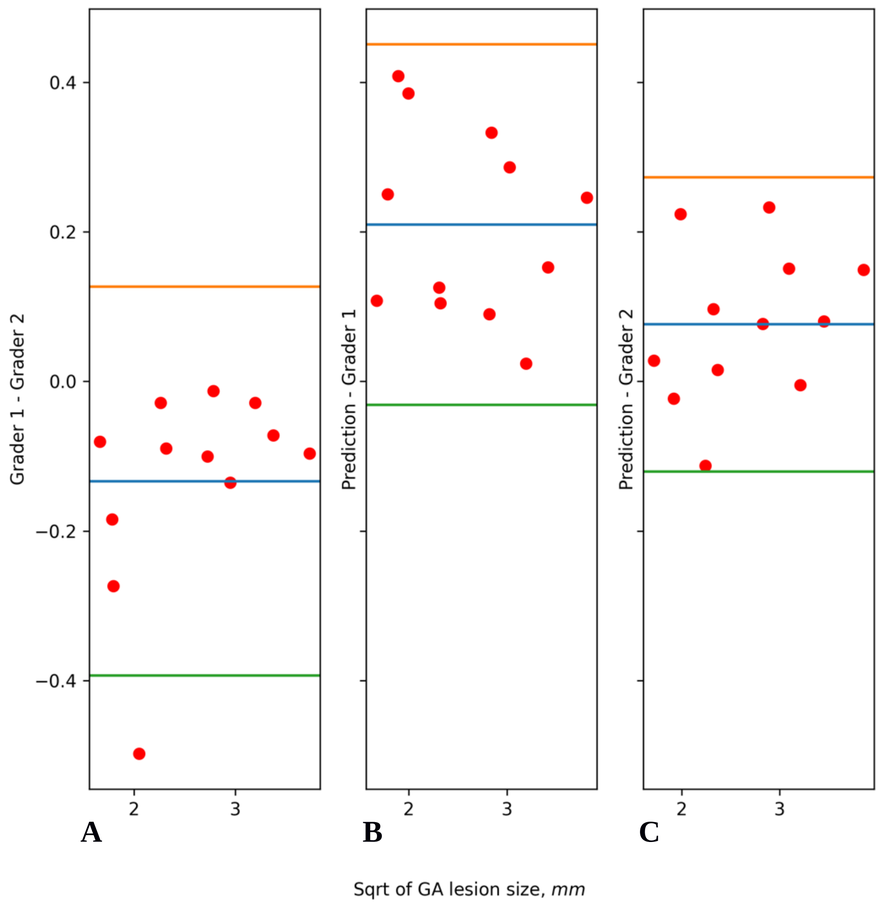
- **3D-to-2D convolutional neural network (CNN)** to automatically segment a topographic 2D GA area on a 3D OCT volume
- **Internal validation set**: OCT volumes from patients with GA from the Medical University of Vienna (MUV)
- **External validation set**: OCT volumes from patients with GA from the FILLY phase II clinical trial
- Compared to a **manually annotated reference** and to the **inter-grader variability** on a subset of OCT volumes
- Automatically segmented square root transformed **GA growth rate** at month 12 was **compared between the treatment groups** of the FILLY trial

Results

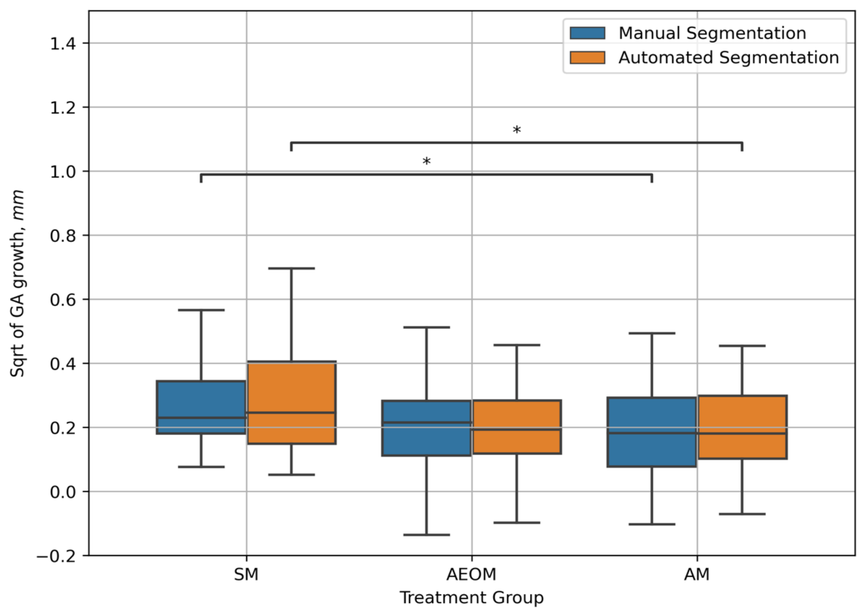
- **Internal Validation (MUV)**: 967 OCT volumes, **mean DSC 0.86 ± 0.12**
- **External Validation (FILLY)**: 226 OCT volumes, **mean DSC 0.91 ± 0.05** (baseline), **mean DSC 0.46 ± 0.16** (month 12)



Examples of **en face segmentation** of GA of a small (first row), medium (second row) and large (third row) baseline lesion size, marked in blue. **(A)** represents the **manually** annotated **baseline** area, **(B)** represents the **automatically** segmented **baseline** area, **(C)** represents the **manually** annotated **growth area** at month 12 marked in red and **(D)** represents the **automatically** segmented **growth area** at month 12 marked in red.



Limits of agreement for inter-grader agreement (A) and model-grader (B, C) agreements of the GA lesion size
ICC (95% CI)
G1 vs. G2: 0.98 (0.93 – 0.99)
P vs. G1: 0.98 (0.94 – 1.0)
P vs. G2: 0.99 (0.96 – 1.0)



Manual vs. automated segmentation of GA growth on OCT at month 12 for the different treatment groups.
*SM vs. AM by automated segmentation: p = 0.030 and manual segmentation: p = 0.028. There was **no statistically significant difference between manual and automated segmented growth rates for all treatment groups**.
SM = sham, AEOM = every other month, AM = monthly treated group

Conclusion

- The proposed **AI approach** can segment and measure **GA area on OCT with high accuracy and precision**.
- The availability of such tools represents an **important step towards AI-based monitoring** of GA progression and **therapeutic response** on OCT for clinical management as well as regulatory trials

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