

A-Eye: Towards a large-scale MRI-based model of the eye

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BACKGROUND

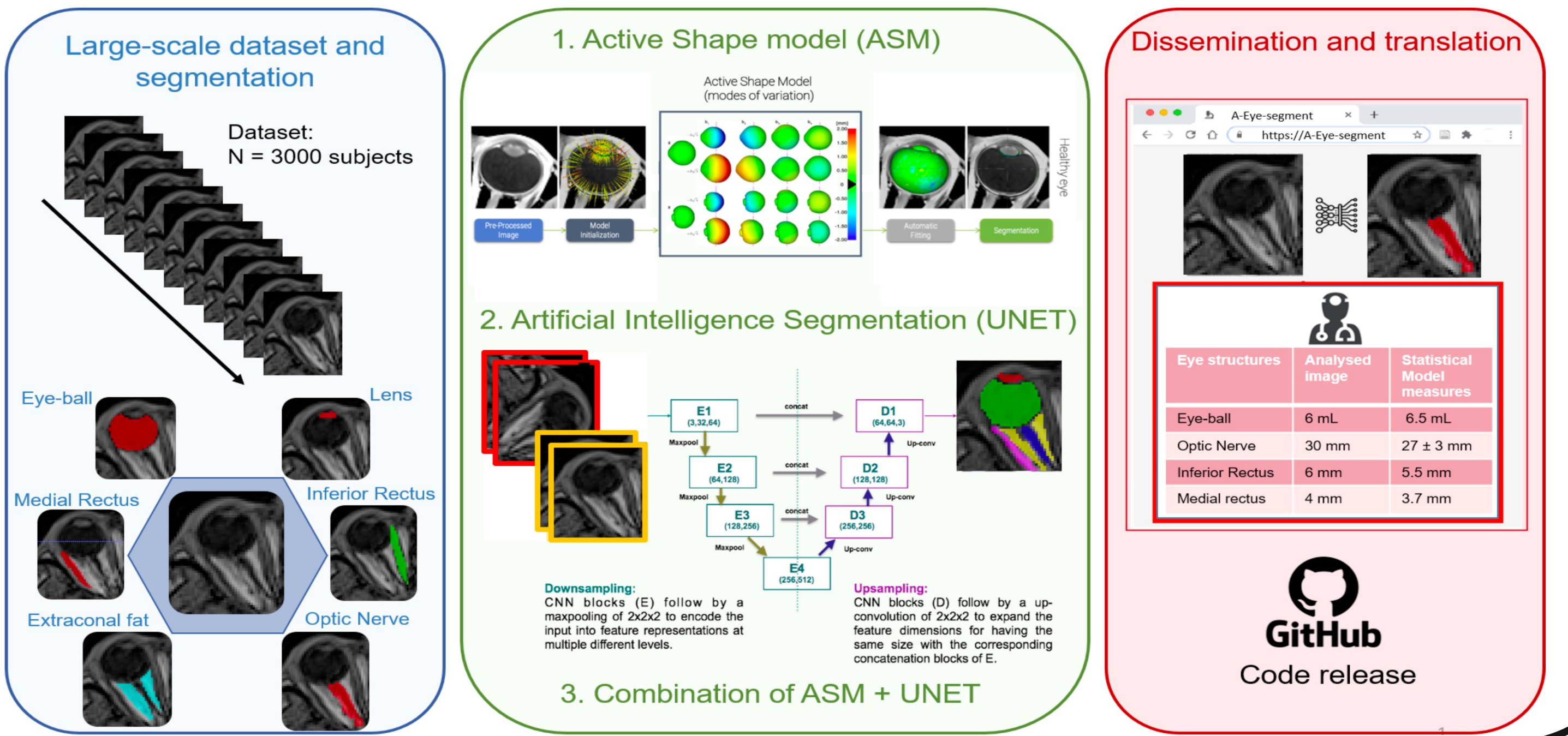
Why Magnetic Resonance Imaging (MRI) of the eye (MReye)?

- Superior **soft tissue contrast penetration**
- **3D image acquisition of the entire eye**
- Useful in some **pathologies** and future **treatment planning**

Improvement with respect to previous work¹⁻⁷:

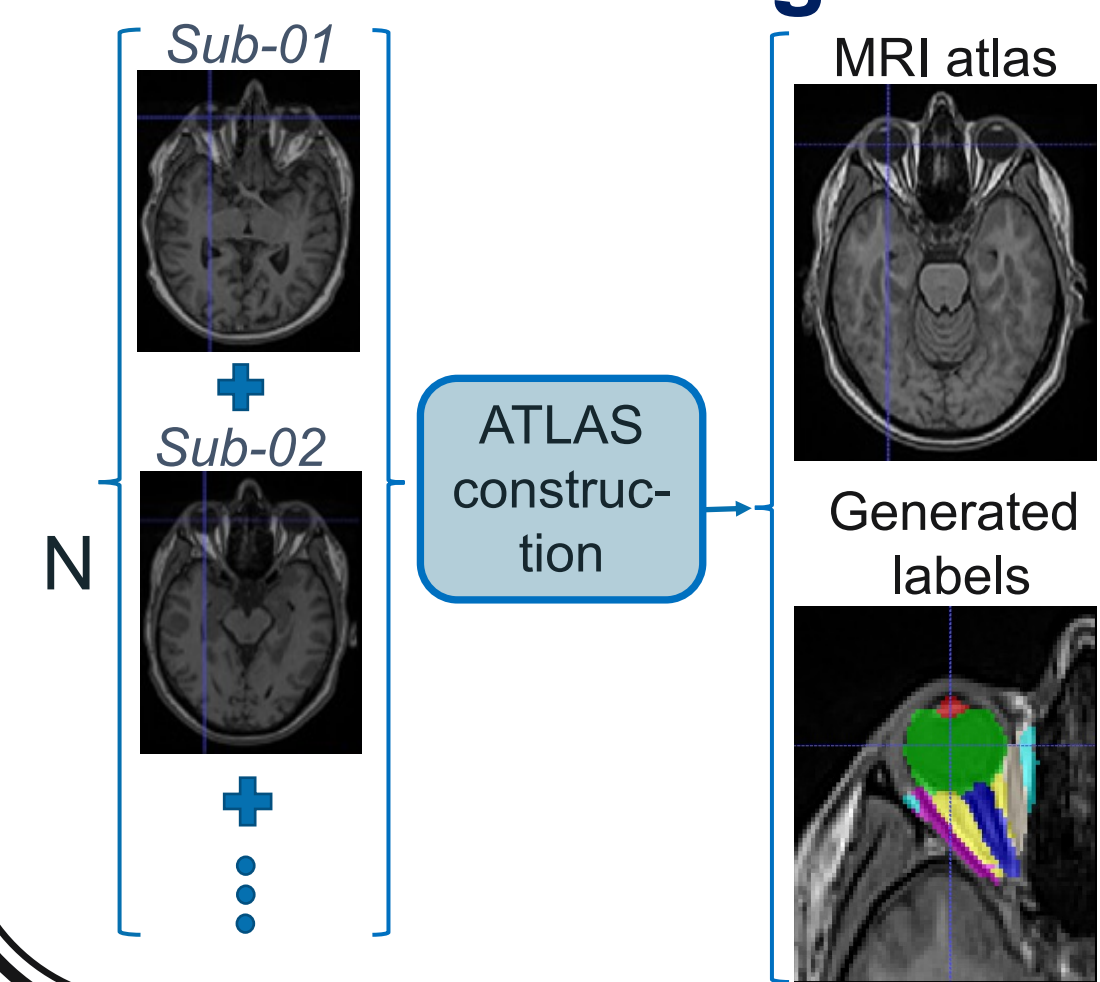
- More ocular structures: lens, globe, **optic nerve, fats, and muscles**
- **Large-scale**
 - **1,200 non annotated subjects**
 - **35 manually annotated subjects**

GOALS

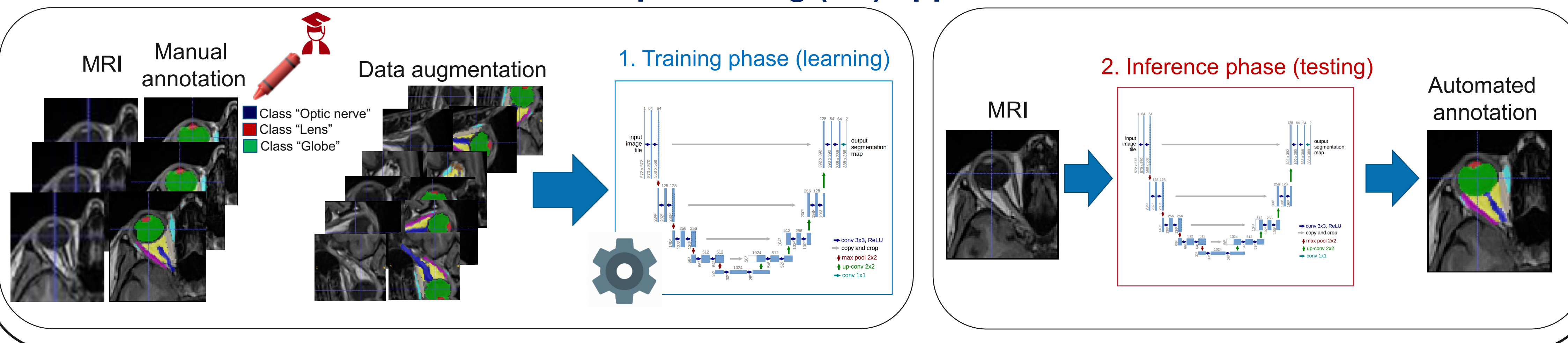


METHODS

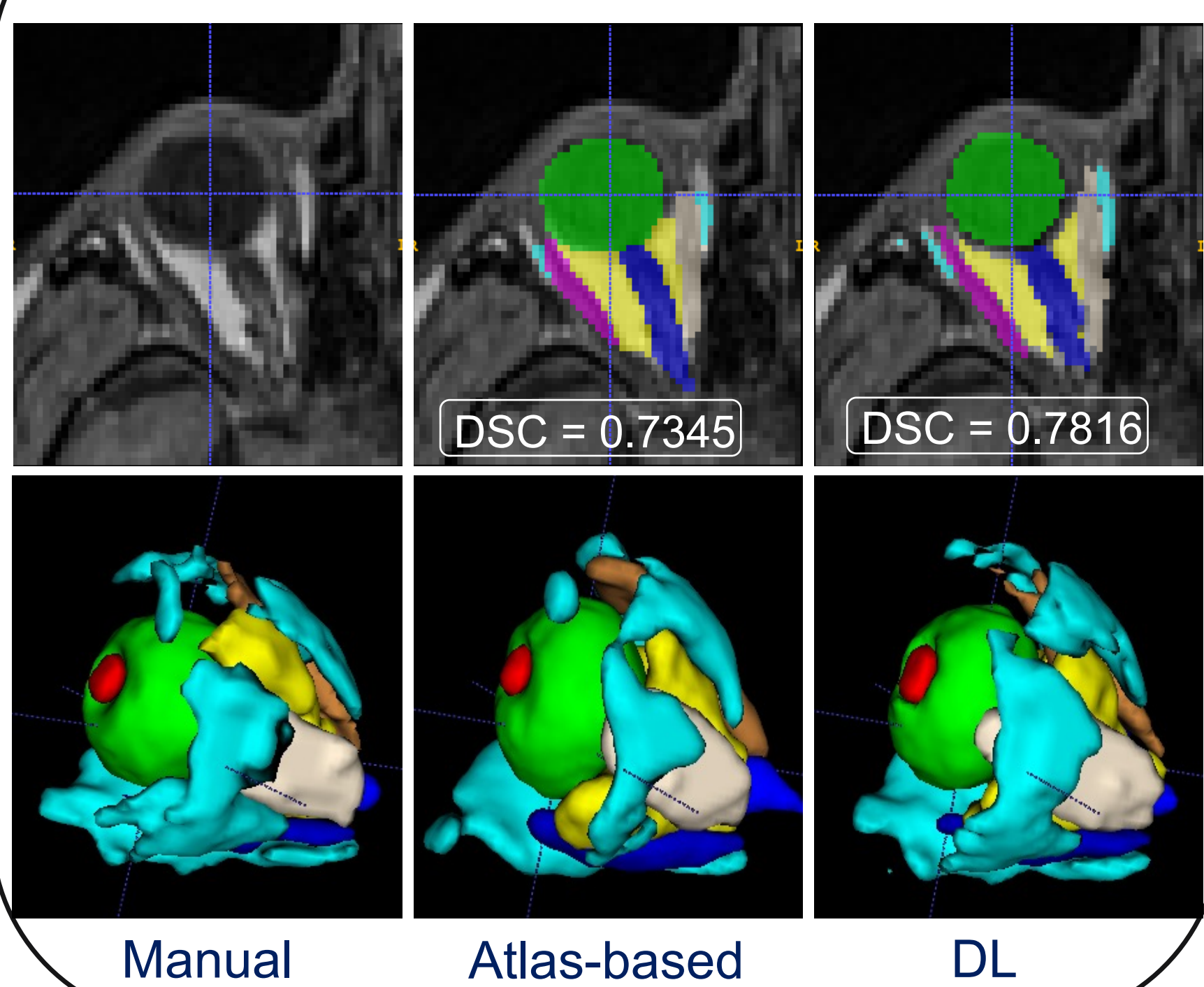
ATLAS-based registration⁸



Deep Learning (DL) approach⁹⁻¹¹



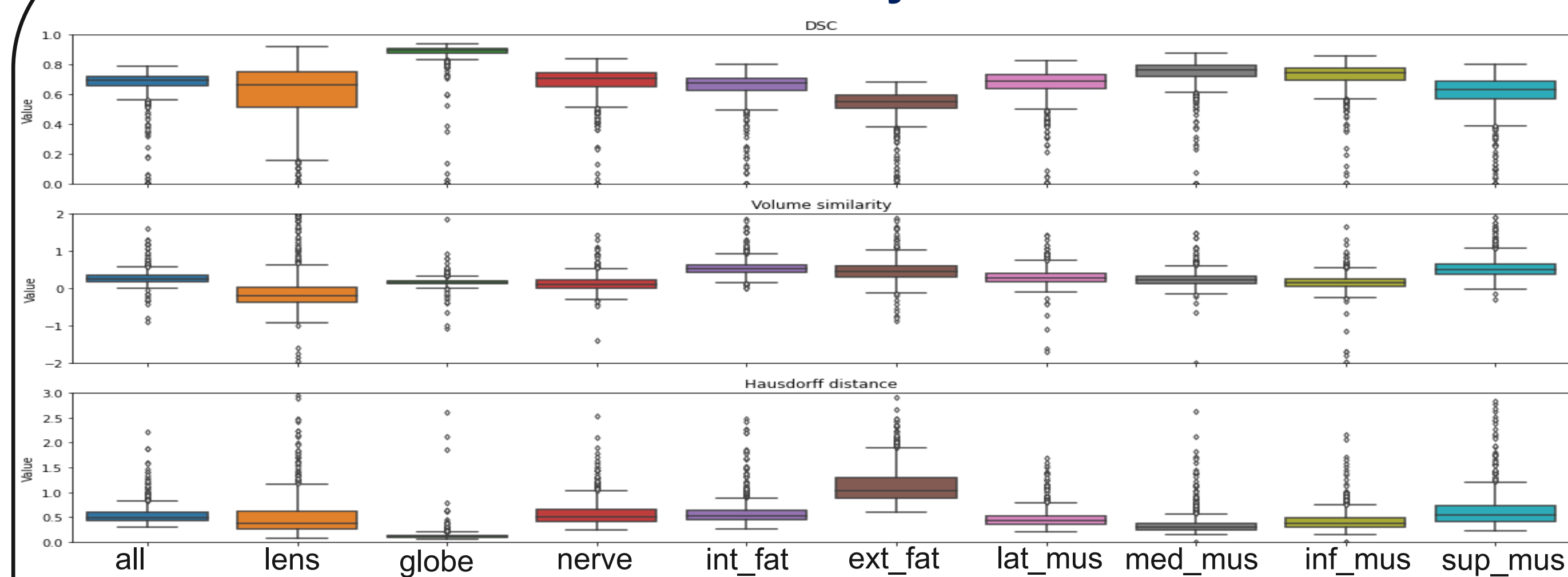
3D visual labels results



RESULTS

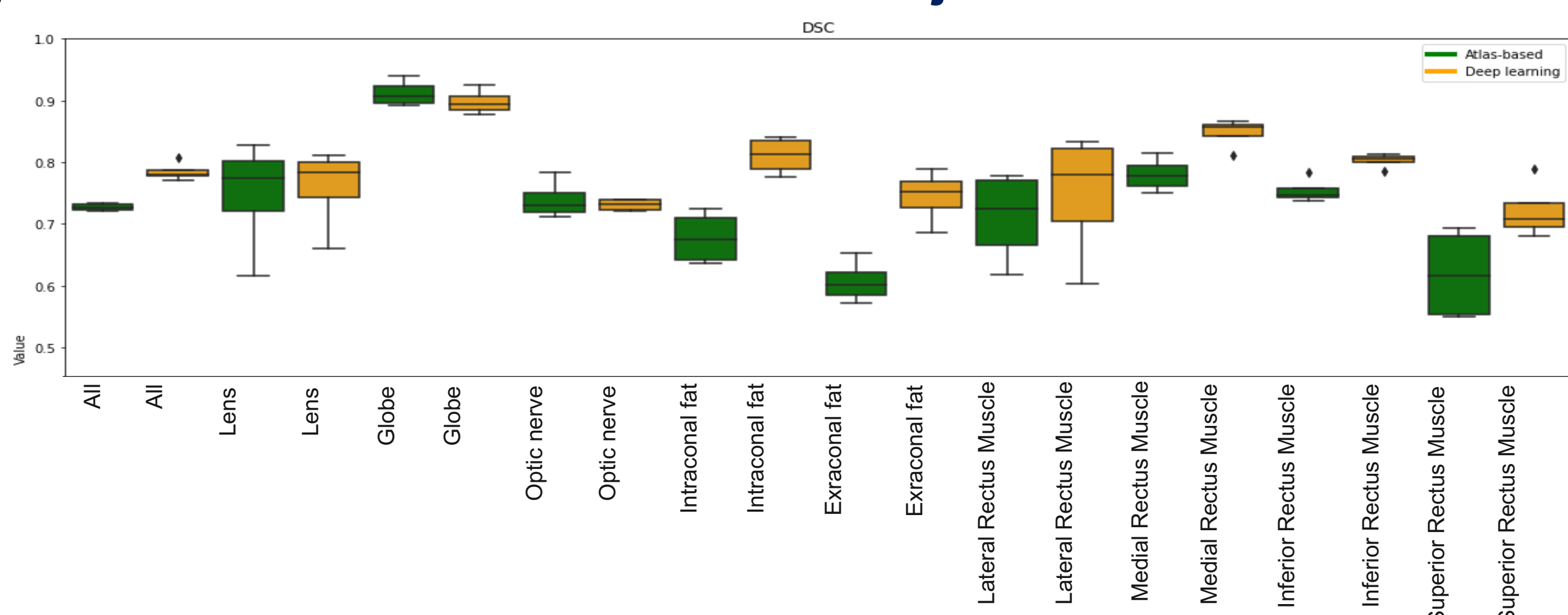
DSC: Dice Similarity Coefficient [0, 1] ↑
Volume similarity: [-2, 2] → 0
Hausdorff Distance [0, ∞) ↓

ATLAS vs DL: Similarity on 1200 subs



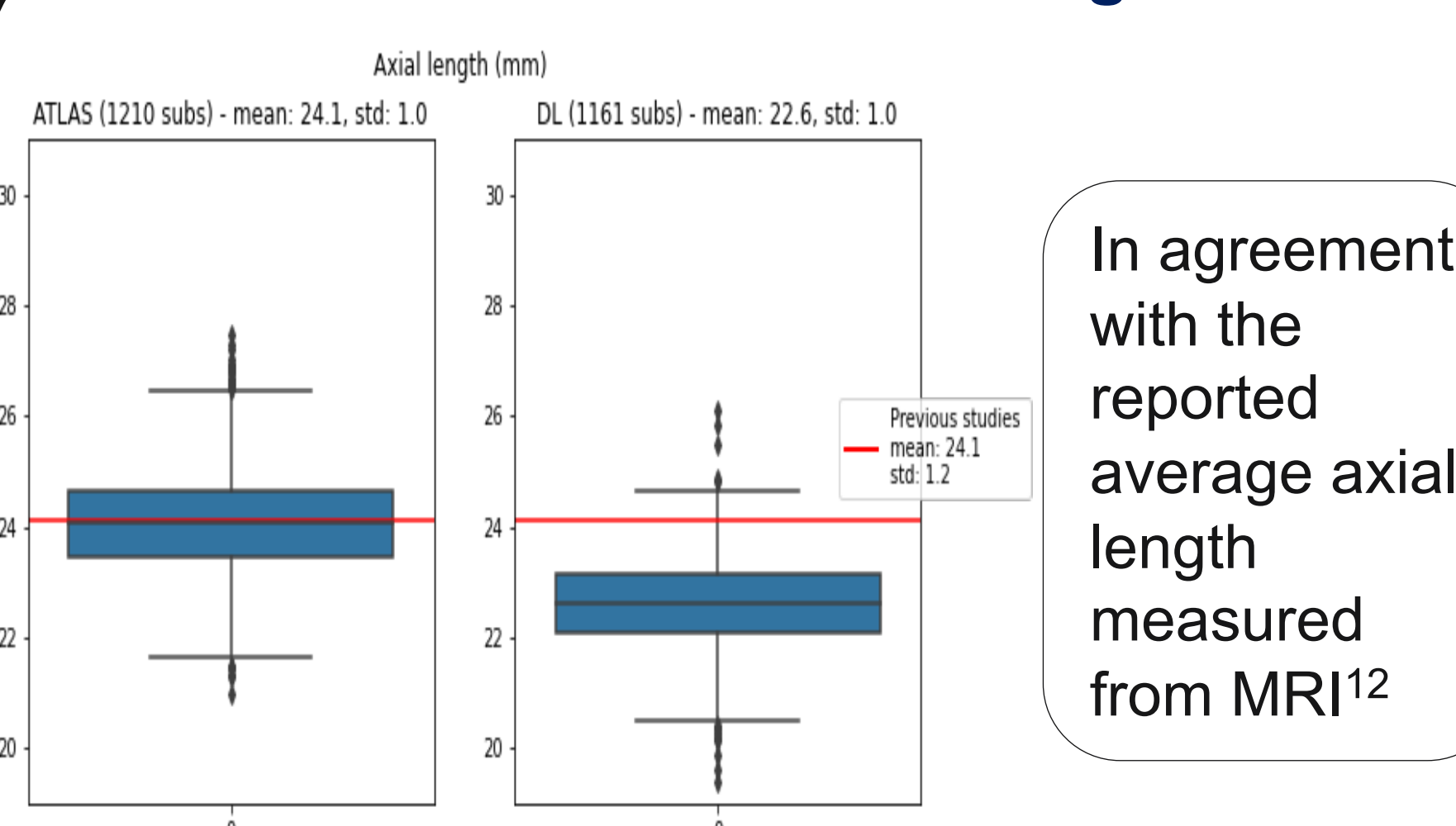
Similar for the globe, variable for the rest (median DSC between 0.55 and 0.76)

ATLAS vs DL: DSC on 4 same subjects with Ground Truth



Improved segmentation accuracy for the DL method (higher DSC values) specially on fats and muscles

ATLAS vs DL: Axial length



In agreement with the reported average axial length measured from MRI¹²

Axial length: distance between the posterior surface of the cornea and the posterior pole of the eyeball, at the boundary with orbital fat

CONCLUSIONS

- **First large-scale 3D MRI segmentation of lens, globe, optic nerve, fats, and muscles**
- **Key ophthalmic biomarkers can be automatically extracted**

FUTURE WORK

- **Deep learning accuracy improvement and baseline development (nnUNet¹³)**
- **Web interface design and development**
- **Automatic extraction of more biomarkers, and correlation with age, gender, BMI**