Project 2: Towards a personalized eye model for the study of ocular tumors based on Magnetic Resonance Imaging

An automatic and accurate eye tumor segmentation from Magnetic Resonance images (MRI) could have a great clinical contribution for the purpose of diagnosis and treatment planning of intra-ocular cancer. Along this line, automatic and effective segmentation of tumors and eye anatomy would be of great value towards a patient-specific eye model. The major challenge to this end however lies in the disease variability encountered over different populations (adults and children), often imaged under different acquisition conditions and high heterogeneity of tumor characterization in location, size and appearance. In this research project our purpose is to develop a unified machine learning framework for the automated segmentation of ocular tumors such as Retinoblastoma (RB) or Uveal Melanomas (UV). Moreover, we would investigate how to extract tumor features to support further Radiomics studies that would be of great value for a better understanding of these pathologies and eventually could support prognosis. This project is based on previous research developed in our laboratory in collaboration with the Jules Gonin Hospital (Prof F. Munier), the Radiology Department (Prof P. Maeder) at the Lausanne University Hospital, the ARTORG center of the University of Bern (Prof. R. Sznitman) and the Paul Scherrer Institute (Dr A. Pica).

Related publications: (1) *"Multi-channel MRI segmentation of eye structures and tumors using patient-specific features"*, Ciller C., et al, PloS One, 12 (3), 2017. (2) *"Personalized Anatomic Eye Model From T1-Weighted Volume Interpolated Gradient Echo Magnetic Resonance Imaging of Patients With Uveal Melanoma"*, Nguyen H.G., et al, International journal of radiation oncology, biology, physics, 102 (4), 2018. (3) *"A novel segmentation framework for uveal melanoma in magnetic resonance imaging based on class activation maps"*, Huu-Giao N., et al , Proceedings of The 2nd International Conference on Medical Imaging with Deep Learning, PMLR 102:370-379, 2019.