

Project Description: Please provide up to one page description of the project. In the first half, briefly include your personal background, experience, and strengths to help show alignment with the project topic, and provide motivation for enrollment in the Independent Study. Later half could include a brief technical description of the topic - such as aim, significance, your implementation plan, and potential Impact. The project aims to detect craniopharyngioma tumors using deep learning or MRI-based imaging models.

Craniopharyngiomas are rare, benign brain tumors located near critical structures such as the optic chiasm and hypothalamus. Accurate delineation of these tumors on MRI is essential for diagnosis, surgical planning, and treatment monitoring. However, manual segmentation is time-consuming, subject to inter-observer variability, and requires expert radiological input. This project aims to develop a robust, automated image segmentation model for craniopharyngiomas using biomedical image analysis techniques. By leveraging expert-annotated MRI datasets, including T1CE, T2, and T2 FLAIR sequences, the model will learn to accurately identify and segment tumor regions, improving efficiency and reproducibility in clinical studies.

Regarding the alignment of my skillset with this project, I have been developing deep learning algorithms for the last eight years, obtained a 4.0 grade for the Applied Medical Image Processing course offered by Dr. Ardekani in fall 2025, and, as part of my master's in math at NYU, attended various machine and deep learning classes until my graduation in 2018. I also have professional experience in the biotech and pharmaceutical industries, where, in my most recent role, I integrated clinical trial datasets and real-world data in the oncology and immuno-oncology spaces. I am also helping a startup engineer deep learning models for an AI inference chip.

Learning Objectives: A brief description the student's goals for her/his education, explaining what they hope to gain in terms of knowledge, skills, etc., including potential intellectual property development (if any), and a short list of specific objectives for the student and the mentor to achieve as a team, by the end of the project. The goal for the student is to deepen their understanding of the technical and clinical aspects of tumor detection in real-world MRI scans, with a particular focus on craniopharyngioma tumors. This includes acquiring specialized knowledge in medical imaging interpretation, neuro-oncology pathology, and the integration of imaging data with clinical variables. Additionally, the student will work toward developing a practical, clinically relevant tool that could support diagnosis or treatment planning, with consideration for potential intellectual property development.

Timeline with Research Mentor: A brief description of the plan for the student to follow, including what the student is expected to do/produce on a regular basis, including the type of activities/assignments and expected dates for completion/submission, for example, reading assignments, presentations, status update report, etc. Note that a final report from the student is due by the end of the project's 14 week period, independent of these agreed-upon deliverables (see Syllabus for details).

The patient population has already been:

- Identified
- Chart reviewed
- MRIs collected and anonymized
- MRIs registered
- Tumors annotated

The student will attend regular meetings related to the CP project, including weekly lab meetings. For the CP meetings, the student will provide progress updates, including presentations of the work and results, including a report detailing the research conducted in the lab.