Pediatric Automatic Defacing to Protect Patient Privacy

**Background**

- Defacing: a technique that removes identifiable facial features from MRI scans without affecting the brain
- Defacing Application: protects patients’ privacy by preventing facial reconstruction

**Objective**

Develop a pediatric specific defacing technique using a convolutional neural network in order to publicly share imaging data and protect patient privacy

**Significance**

- Commonly used defacing methods, such as MiDeface, are created for adult subjects with T1-weighted images
- Deep learning will create a more generalizable defacing model than the mathematical algorithms currently available
- Model will better adapt to rapid development of brain structures that occurs in pediatric scans and account for different MRI types

**Data**

- Data was collected from the Children’s Brain Tumor Network
  - Unprocessed and treatment naive scans
  - Large-scale and multi-institutional
- Age Range: 4 months - 21 years; Average Age: 9 years
- Tumor Types: Medulloblastoma and Glioma

**Methods**

- Used MiDeface to generate initial facemasks for 186 pediatric subjects in Flywheel
  - Every subject had a T1, T1ce, T2, and Flair scan
- Used editing software to correct 386 scans that were inaccurately defaced by MiDeface
  - Filled in facial features needing further defacing and restored impacted brain voxels
- Accurate facemasks were divided into training and testing data to develop the defacing model using nnU-Net: a deep learning model used for imaging data
- Performance metrics including dice similarity score, sensitivity, and Hausdorff95 were calculated

**Results**

**Facemask Comparison**

Example Subject (Dice Score = 0.869)

Model Generated Facemask:

Manually Generated Facemask:

**Performance Metrics Definitions**

- Dice Similarity Score
- Hausdorff95

**Conclusions**

- Visually the model is performing very well and generates accurate facemasks according to median dice similarity score
- Low outlier dice scores were a result of manual edits made to facemasks rather than an indication of an inaccurate model

**Next Steps**

- Find new method of evaluating model performance
- Modify training data to improve model performance
- Assess facemask’s effect on current 3D rendering software
- Deploy software as a gear on the flywheel data management platform

**References**

1. This research was conducted using data and/or samples made available by The Children’s Brain Tumor Network