Auto-initialization using Deep Learning

- **Problem Statement:**
  - Registration algorithms require an initial $F_{\text{guess}}$. Algorithms can be very sensitive to this initialization, and manual initializations can be time consuming.

- **Project Statement:**
  - Automatically initialize registrations intelligently using deep learning for scene matching in medical images of different modalities (video frames and CT rendering)

  ![Simulated video frame](image1) ![Corresponding camera view in CT rendering](image2)

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- **What Students Will Do:**
  - Work with simulation data (with known truth)
  - Figure out what kind of neural network is best for this application
  - Train a neural network to learn camera transformations that produce a CT rendering that matches the video scene
  - Test the neural network on simulation data to see if that correct transformation can be recovered

- **Deliverables:**
  - Trained and tested neural network
  - Can it produce an $F_{\text{guess}}$ that matches the truth in simulation?
  - Perform registration starting from the predicted $F_{\text{guess}}$ using at least one established registration algorithm (e.g., ICP)
  - Perform registration using multiple established registration algorithms to assess the quality of the initialization using different methods
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- **Size group:**
  - No more than 3, if more split into sub-projects

- **Skills:**
  - Deep learning (at least some understanding, can learn more as you go)
  - Python (preferably, but Matlab/C++ also work)

- **Mentors:**
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