Image Guidance for Robot-Assisted Ankle Fracture Repair: Mini-Checkpoint

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Project Summary

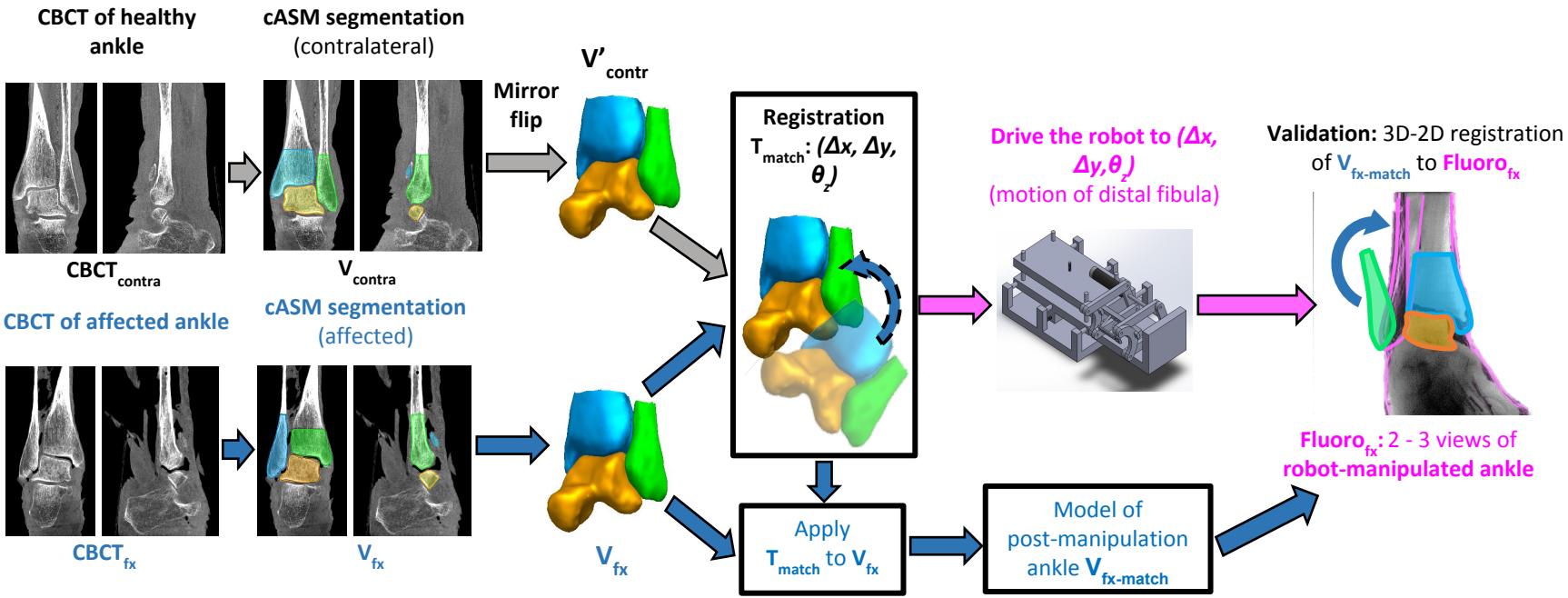


Figure by Wojtek Zbijewski

Deliverables: Before Spring Break

Minimum	Expected	Maximum
○ Validate accuracy of Coupled Active Shape Model with average segmentation error of 5 mm for high quality cone beam images ○ Perform error analysis on failure modes on low quality CT images	○ Validate accuracy of joint deep learning - cASM model with mean segmentation error of 2mm for low quality CT images of healthy/unhealthy ankles	○ Publish paper ○ Perform cadaver experiment to validate accuracy of models

Deliverables: Update

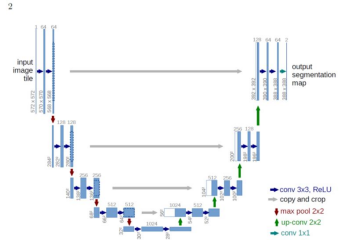
Minimum: Complete	Expected: In Progress	Maximum: Incomplete
○ Validate accuracy of Coupled Active Shape Model with average segmentation error of 5 mm for high quality cone beam images ○ Perform error analysis on failure modes on low quality CT images	○ Validate accuracy of joint deep learning - cASM model with mean segmentation error of 2mm for low quality CT images of healthy ankles without metal artifacts	○ Publish paper ○ Incorporate metal artifacts and unhealthy ankle data into deep learning - cASM model with mean segmentation error of 2mm

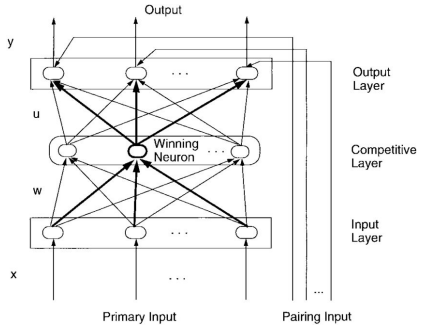
cASM Updates and Obstacles

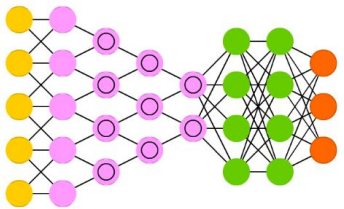
- cASM model works for CBCT data
- Difficulty registering mean shape model to C-arm data due to different voxel sizes and different axes.

Neural Net Updates and Obstacles

- Developing Convolutional Neural Network (CNN)
  - 2D inputs (slices of CT images)
- Created framework to create separate models for each bone
  - Same architecture for each bone
  - Different model and coefficients for primitive operations
- Obstacles
  - Lack of data
    - Some images have metal artifacts
    - Solution: rotate images and pad
  - Long training time
    - Obtained Remote access to Lab Computers but training times are long even with GPU cluster







Next Milestones

- Complete registration of mean active shape model to C-arm images
- Develop deep learning approach for low quality C-arm images
- Incorporate metal artifacts reduction algorithms to clean up data