Automated RGBD to C-arm Calibration

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Introduction
- Orthopedic surgeries require difficult tool placement
- Many X-rays are taken to ensure correct placement
- Creates mixed-reality visualization increases patient safety (fewer X-rays, shorter duration)
- Built an automated calibration algorithm to register a Cone Beam Computer Tomography (CBCT) scanner and Red-Green-Blue Depth Camera (RGBD)

Problem
- RGBD and CBCT have different origins and physical properties (attenuation coefficient and depth), requires rigid transformation
- Manual calibration algorithm is time and expertise intensive

Solution
- Developed a faster and automated calibration algorithm to calibrate CBCT to RGBD
- Four modules with graphical user interface (GUI)

Results
- Successfully automated the manual calibration without the segmentation of point clouds
- Correctly extracted CBCT point cloud from noise
- Results had comparable mean squared error (MSE)

Future Work
- Automated algorithm does not segment point cloud
- New phantom that does not need segmentation

Lessons Learned
- Methodology and culture of research group
- Exploration of third party software and libraries (ImFusion SDK, MeshLab, PCL, ITK)
- Build large C++ application with Qt GUI and numerous dependencies

References