Scoliosis is a pathological curvature of the spine which typically manifests during adolescence and develops during growth. The disease is quantified in terms of the Cobb angle, defined as the maximum angle between the end-plates of any two vertebrae. The choice of treatment for the disease depends on the observed Cobb angle. Typically, continued monitoring is performed for angles less than 20o, bracing for angles between 20o and 40o, and surgical vertebral fusing for angles in excess of 40o. Since bracing can prevent the disease from progressing to the point of requiring surgical intervention, regular monitoring and accurate quantification of the disease are crucial.

The gold-standard for scoliosis diagnosis and quantification is x-ray imaging as it provides a clear depiction of the necessary anatomy. The harmful side-effects of repeatedly exposing adolescents to the ionizing radiation required for x-ray imaging has motivated research into using spatially tracked ultrasound imaging to quantify the disease. It has been shown that ultrasound can be used to locate the vertebral transverse processes, providing a proxy to the true Cobb angle. However, because of the difficulty of interpreting ultrasound images, and the idiosyncratic nature of scoliotic anatomy, the locations ascribed to transverse process landmarks are often inconsistent or inaccurate. Sometimes certain transverse processes cannot be located at all.

Therefore, I propose training a neural network [WHAT KIND???] on known locations of transverse processes of scoliotic patients to produce accurate estimations of the Cobb angle from inaccurate, and incomplete anatomic landmark data.

The data I will use to train the neural network consists of the locations of over 100 scoliotic patient’s transverse processes, which I marked from CT scans they previously had undergone. I will save some of these patients’ landmark sets to validate the neural network. In the validation sets, I will simulate the difficulties encountered in ultrasound imaging by deleting and misplacing some of the landmarks. The neural network will then be used to estimate the Cobb angle of the patients corresponding to these deliberately degraded anatomic landmark data sets. The performance of the network will be validated by comparing its output to the Cobb angle I manually measure from the CT scans, which serve as ground truth.