

Predicting Adolescent Idiopathic Scoliosis using Data Mining Method PSED Cluster 2018-2019

Graduate Student Fellows:
HENGYANG LI
MAHSA TAJDARI

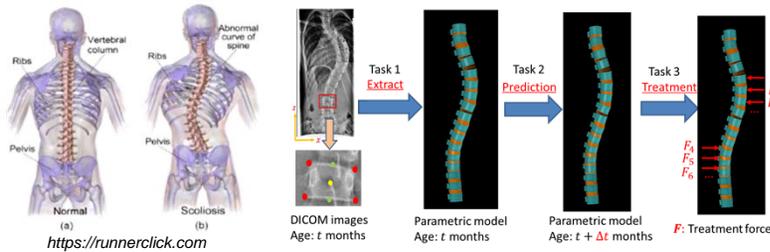
Faculty Advisors:
WING KAM LIU
GREGORY WAGNER

Academic Disciplines:
MECHANICAL ENGINEERING, MEDICAL SCIENCE
COMPUTER SCIENCE

June 13, 2019

RESEARCH OBJECTIVE

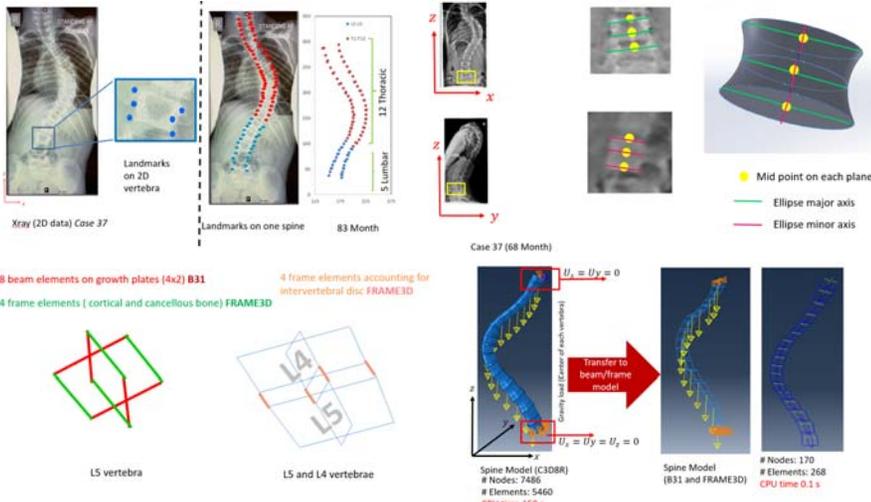
Scoliosis, 3D deformation of the human spinal column, is characterized by a lateral deviation of the spine, accompanied by axial rotation of the vertebrae. In this research, the primary focus is on Adolescent Idiopathic Scoliosis (AIS) which is the most common type of scoliosis affecting children mostly between ages 8 to 18 which bone growth is at its maximum rate. The treatment of scoliosis is highly dependent on the scoliosis curve. Currently, the treatment of scoliosis is guided by available medical devices which mostly based on the surgeon's experience. Developing a clinically validated patient-specific model of the spine would aid surgeons to understand the AIS in early stage and propose an efficient method of treatment for individual patients. This project has three steps: 1) Develop a clinically validated patient-specific FEM of the spine. 2) Predict AIS (Adolescent Idiopathic Scoliosis) progression using data mining. 3) Propose an efficient method of treatment.



<https://runnerclick.com>

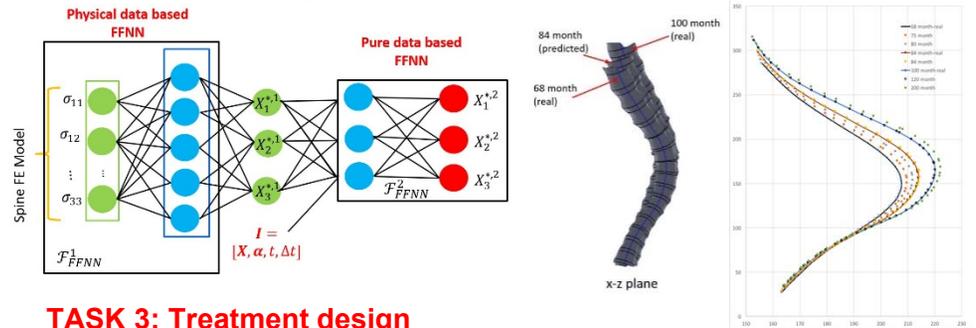
TASK 1: Finite element model of the spine

- Extract landmarks from DICOM(Digital Imaging and Communications in Medicine) images
- Generate parametric model using landmarks
- Generate beam model to accelerate calculation



TASK 2: Predicting the spine curvature using data mining

The second task is a physical guided finite-element neural network for predicting the spine curvature. Physical guided neural network (PGNN) is a neural network trying to solve problem with physical equations.



TASK 3: Treatment design

For moderate deformities in the spine, bracing is the most common treatment. In the current study, a patient-specific treatment force could be designed to target affected area and modify spine deformities in an optimized way. The spine shape will be transferred into the parametric model and FEM solver. An initial treatment force will be applied as an initial guess. After several iterations, the spine curvature will be moved closer to the targeted shape.

