3D LUNG VOLUME CALCULATION FOR SCOLIOSIS PATIENTS

FEAR OF GENETIC DISCRIMINATION

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SOCIOTECHNICAL SYNTHESIS

Genetic testing has the potential to improve patient care through offering earlier treatment and increased personalization of care. The technical research report describes an innovative method for physicians to aid in their treatment of early onset scoliosis. Through using a convolutional neural network and patient demographics, an algorithm can report the total lung capacity of a patient, which physicians use to determine the optimal time for surgical intervention. The STS research paper analyzes the existing fear of genetic discrimination in the United States and offers a method for mitigating this fear. The diminished fear surrounding genetic testing should allow its potential to substantialize. Early onset scoliosis can be caused by genetic mutations; therefore, both the technical and STS projects aim to improve the treatment of patients with genetic disorders.

Scoliosis is caused by a three-dimensional rotation of the spine and early onset scoliosis is a specific class where the curvature develops before the age of ten. Spinal fusion surgery is the standard form of operative treatment. Physicians use the total lung capacity to inform their decision on surgical timing. Though in many early onset scoliosis cases, the traditional methods for measuring total lung capacity are unavailable. In the technical report, a method is described using a convolutional neural network to calculate the rib cage volume and a predictive equation is used to calculate the mediastinum volume. The result of subtracting the mediastinum volume from the rib cage volume is equal to the total lung capacity.

The algorithms for determining rib cage and mediastinum volume were separately constructed. Two models were built to determine rib cage volume, one used lateral X-ray images and the other used posterior-anterior X-rays. These two models produced an accuracy below the original aim. The equation constructed for mediastinum volume prediction was based on patient

demographics. This equation achieved higher statistical significance compared to the rib cage identification. Future work should focus on improving the accuracy of the rib cage models and combining the two parts to form a unified algorithm.

In the United States, people fear their genetic information will be used by insurance companies to raise their premium costs. Although barriers exist to prevent this fear becoming a reality, the fear persists. The public has a lack of knowledge concerning the situation and legislators are not aware of the fear held by the public. Scholarly papers, which conducted surveys on both the public and legislators, were used to prove the lack of information among the group. Additionally, a science, technology, and society framework was used to analyze the relationships between the relevant social groups.

Patients have refused to undergo a genetic test due to their fear of genetic discrimination. Further, the research conducted demonstrated the lack of communication between the social groups. In order to diminish the fear held by the public, interaction between the social groups needs to increase. An increase in communication can lead to an increase in knowledge across the groups. Focus groups have been identified as a possible solution for effective communication. The learned information from focus groups should diminish the fear of genetic discrimination in the United States.

Through two different scopes, the goal of this work is to improve the treatment of patients with genetic disorders. Physicians can use the algorithm to improve the treatment of early onset scoliosis cases. Additionally, through mitigating the fear of genetic discrimination, the promises of genetic testing can occur, and treatment should improve for a variety of genetic disorders.

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