

CS7180: Final Project Proposal

Problem Statement

Undetected fractures can lead to complications like chronic pain or permanent disability. To detect these fractures, radiologists and medical providers need to review x-rays or other medical images and determine the appropriate diagnosis. However, there is still a significant number of fractures, especially spinal fractures, that are missed. Cervical spine fractures in particular may be missed over 50% of the time. Our goal is to see if we can create a network to detect these fractures at a higher accuracy.

Data Sources

- Statistics for misdiagnosed fractures
 - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6179080/>
- Review paper on using deep learning CV techniques for medical use:
 - <https://www.nature.com/articles/s41746-020-00376-2>
- A neural network approach for bone fracture healing assessment
 - https://ieeexplore.ieee.org/abstract/document/59209?casa_token=WLhgg78Djh8AAAAA:HsXTINvXsnNB6aPrcmSxudMrnHFsYoQrkUHXrd09bf4N00zQGvMUMDAAdTTJceJ9NT1lpOxGF6Ms
- Bone fracture detection through the two-stage system of Crack-Sensitive Convolutional Neural Network
 - <https://www.sciencedirect.com/science/article/pii/S235291482030602X>
- Ensemble artificial neural networks applied to predict the key risk factors of hip bone fracture for elders
 - https://www.sciencedirect.com/science/article/pii/S1746809415001044?casa_token=i-0-kPuBcCUAAAAA:rdmMsjrWHw7UI3GN6LjsSFn2Sfr0DEHwd2ecRI7EezhrGj4fKhiNgs07AQHtdFKiaTk-K9_m4E
- Cervical spine fractures dataset:
 - <https://www.kaggle.com/competitions/rsna-2022-cervical-spine-fracture-detection/overview/description>
 - <https://www.kaggle.com/datasets/jirkaborovec/cervical-spine-fracture-detection-equalized-png>

Implementation Plan

Use a database of cervical spine images with fractures and no fractures to train and test a CNN and experiment with the parameters or architecture (like a CNN with LSTM) to see if we can obtain a fracture prediction network with a higher than human accuracy (50% or higher).

Useful links:

- Paper to recreate:
 - <https://ieeexplore.ieee.org/document/8857277>
- Montgomery dataset
 - <https://openi.nlm.nih.gov/faq#faq-tb-coll>
- Pneumonia dataset (used in paper)
 - <https://www.kaggle.com/competitions/rsna-pneumonia-detection-challenge/data>
- Kaggle dataset (not used in paper)
 - <https://www.kaggle.com/datasets/paultimothymooney/chest-xray-pneumonia?datasetId=17810>
- CNN for COVID diagnosis in CXRs
 - <https://paperswithcode.com/paper/chest-x-ray-image-phase-features-for-improved>
- Squeeze-and-excitation network
 - <https://amaarora.github.io/2020/07/24/SeNet.html>
 - <https://arxiv.org/abs/1709.01507>
- ResNet34
 - <https://pytorch.org/vision/main/models/generated/torchvision.models.resnet34.html>
 - <https://www.analyticsvidhya.com/blog/2021/09/building-resnet-34-model-using-pytorch-a-guide-for-beginners/>