RSNA Cervical Spine Fracture Detection

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Research Question

How can we quickly detect and locate vertebral fractures in the cervical spine from CT scans to aid in the prevention of neurologic deterioration and paralysis after trauma?

Justification

In the US alone, there are 17,730 spinal cord injuries every year (Morano et al. 2021). According to the Kaggle competition, most of these spinal cord injuries occur in the cervical spine (neck) (*RSNA 2022 Cervical Spine Fracture Detection* 2022). There has also been a rise in the incidences of spinal fractures in the elderly and this population, fractures can be more difficult to detect on imaging. Superimposed degenerative disease and osteoporosis is one of the main factors leading to this difficulty. It is a problem since most of these image diagnosis are done almost exclusively using computed tomography (CT) (Munera et al. 2012) instead of radiographs (x-rays).

According to the National Spinal Cord Injury Statistical Center about 39.3% of these spinal cord injuries are from vehicle crashes. And another 31.8% from falls (Center 2019). Therefore, quick detection of vertebral fractures and their location is essential when preventing deterioration and paralysis after trauma. Therefore, through this project, we will be aiming to first detect vertebral fractures, and second if possible, the location of cervical spine fractures. The main aim is to match the radiologists' performance

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since the dataset we are using was professionally annotated by Spine radiology specialists from the American Society of Neuroradiology (ASNR) and the American Society of Spine Radiology (ASSR).

Data Collection Strategies

For this project, the main source of the dataset is Kaggle where the image data and labels have already been given. This was convenient because we did not have to go through hoops of determining whether or not we can scrape data from a given website. It also meant that we did not have to spend time figuring out what type of data to collect and what is relevant for a given scenario.

However, we did not anticipate the challenge that would come with working with over 300 GB of image data with laptops meant for school work. This is a challenge that was unexpected and took significantly longer o work through than we planned for. Specifically, the breakdown of the challenges and how we overcame them is as follows:

1. With 300 GB of data, it meant we needed to have at least 600 GB of local storage because the data was zipped: the zipped file would be 300 GB and the unzipped file would be 300 GB. Haitham bought an external hard disk with enough storage to store this data and was able to successfully download the data.

2. The unzipping of the data took a very long time: at least 14 hours. Since this was a long wait time, we also looked into alternatives: we found a jpg dataset with a much greater reduction in size (59 GB).

3. Github has a limit on the size of files you can upload and therefore couldn't upload the data to Github. Instead we uploaded the image data to a Google Drive folder and we will read the data into a Google Colab file that is in the same directory as the folder of images.

References

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