

## Title: Project 1(Cervical Spine Fracture Detection) of EC601

## 1. Problem statement:

(reference:<https://www.kaggle.com/competitions/rsna-2022-cervical-spine-fracture-detection/overview>)

RSNA 2022 Cervical Spine Fracture Detection is aimed to detect and identify the cervical spine(neck) fracture using AI models. With the help of authentic dataset, which is sourced from twelve sites on six continents, including approximately 3,000 CT studies, participants should be able to develop machine learning models of which the identification results are consistent with the judgment from radiologists.

## 2. Applications:

- a. It will help radiologists and doctors to confirm their judgment for patients and improve their working efficiency since they could use the training model to select CT scans which have the possibility of neck fracture in advance. In other words, the quick and precise detection of spine fracture is of great importance in preventing neurologic deterioration and paralysis after trauma.
- b. It could be a significant example and practice for medical image processing. Through training the dataset of neck fracture and developing models, the accuracy of identifying fractures will be much more improved. So we could try or modify some of the excellent models to apply them to other related fracture problems, such as lumbar vertebrae fracture.

## 3. Papers and resources:

- a. Small JE, Osler P, Paul AB, Kunst M. CT Cervical Spine Fracture Detection Using a Convolutional Neural Network. *AJNR Am J Neuroradiol*. 2021 Jul;42(7):1341-1347. doi: 10.3174/ajnr.A7094. Epub 2021 Apr 1. PMID: 34255730; PMCID: PMC8324280.
- b. Miura M, Maki S, Miura K, Takahashi H, Miyagi M, Inoue G, Murata K, Konishi T, Furuya T, Koda M, Takaso M, Endo K, Ohtori S, Yamazaki M. Automated detection of cervical ossification of the posterior longitudinal ligament in plain lateral radiographs of the cervical spine using a convolutional neural network. *Sci Rep*. 2021 Jun 16;11(1):12702. doi: 10.1038/s41598-021-92160-9. PMID: 34135404; PMCID: PMC8208978.
- c. Voter AF, Larson ME, Garrett JW, Yu JJ. Diagnostic Accuracy and Failure Mode Analysis of a Deep Learning Algorithm for the Detection of Cervical Spine Fractures. *AJNR Am J Neuroradiol*. 2021 Aug;42(8):1550-1556. doi: 10.3174/ajnr.A7179. Epub 2021 Jun 11. PMID: 34117018; PMCID: PMC8367597.
- d. Burns JE, Yao J, Summers RM. Vertebral Body Compression Fractures and Bone Density: Automated Detection and Classification on CT Images. *Radiology*. 2017

Sep;284(3):788-797. doi: 10.1148/radiol.2017162100. Epub 2017 Mar 16. PMID: 28301777; PMCID: PMC5584647.

- e. Li YC, Chen HH, Horng-Shing Lu H, Hondar Wu HT, Chang MC, Chou PH. Can a Deep-learning Model for the Automated Detection of Vertebral Fractures Approach the Performance Level of Human Subspecialists? Clin Orthop Relat Res. 2021 Jul 1;479(7):1598-1612. doi: 10.1097/CORR.0000000000001685. PMID: 33651768; PMCID: PMC8208416.
- f. <https://www.kaggle.com/code/andradaolteanu/rsna-fracture-detection-dicom-images-explore>
- g. <https://www.kaggle.com/code/samuelfcortinhas/rsna-fracture-detection-in-depth-ed>