Indo-Korea Science and Technology Center

CHRIST (DEEMED TO BE UNIVERSITY) BANGALORE, INDIA

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Automated localization and classification of bone fractures in radiology

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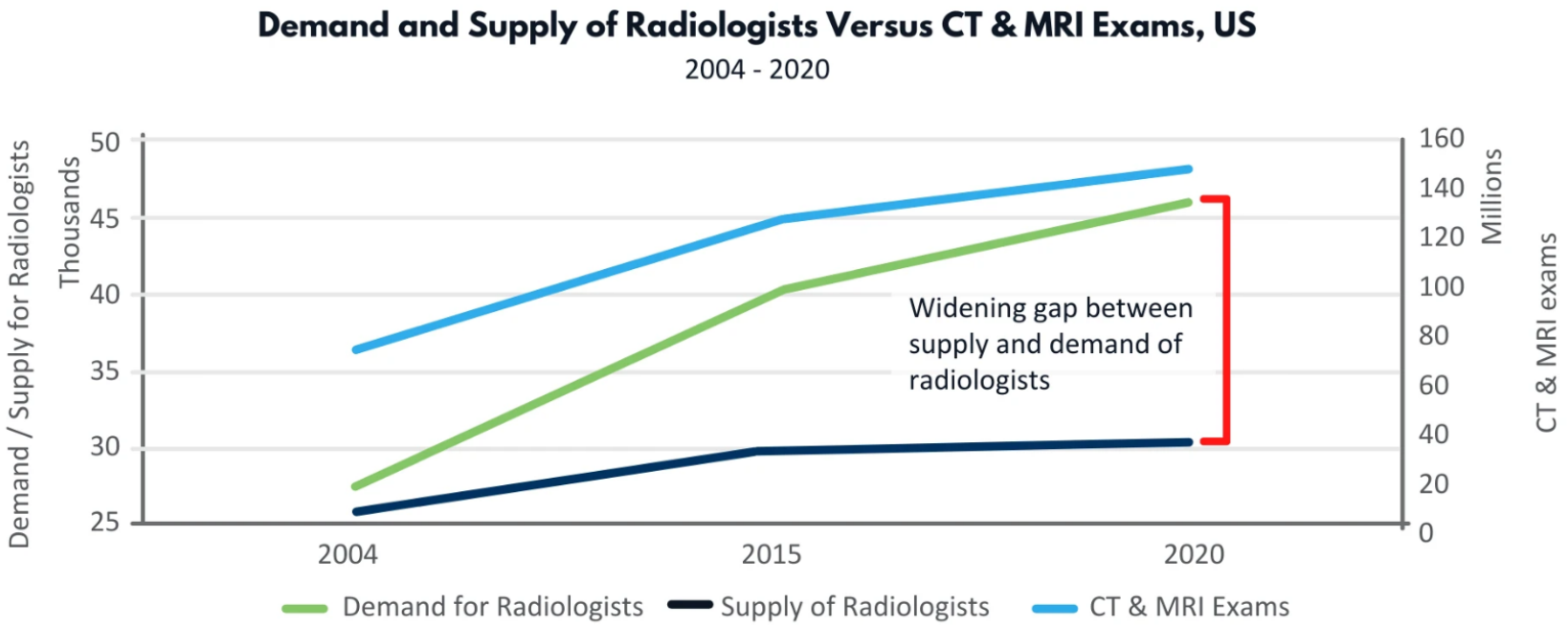
Context & Problem statement

- A Radiologist plays a critical role in patient care
- Time is critical in assessing and reporting fractures
- Global shortage of radiologists



Context & Problem statement

- Shortage causes backlog of patients waiting for CT scans is growing quickly
- Fast growing and older population increases requirement for more imaging
- Delayed X-ray for cancer treatment raises the risk of death
- Increase use of Teleradiology for emergency situations across U.K
- “Staff shortages at radiology departments across New Zealand could cost lives”

Proposed Solution & Novelty

- Automated detection of bone fractures in radiology
- Detect the fractures of both normal and High priority scans
- Reduces the time taken to produce results
- Better time prioritization and utilization for radiologists

Methodology & Implementation

Dataset

- **Large Datasets required for Training**
- **Datasets are split into 70% for training, 15% for validation and 15% for testing**

1 – Musculoskeletal Radiographs (MURA)

- This dataset contains X-ray images of different bones

2 – Kaggle Dataset (ChestPelvisCSpineScans)

- This dataset contains mixture of Chest, Pelvic And C-spine Fracture

3 – Acquiring Dataset from Large Hospital chains

Methodology & Implementation

Algorithm, Methods and Models

1 - Traditional Methods

I. informative region selection
II. feature extraction
III. classification of the object

Methodology & Implementation

Algorithm, Methods and Models

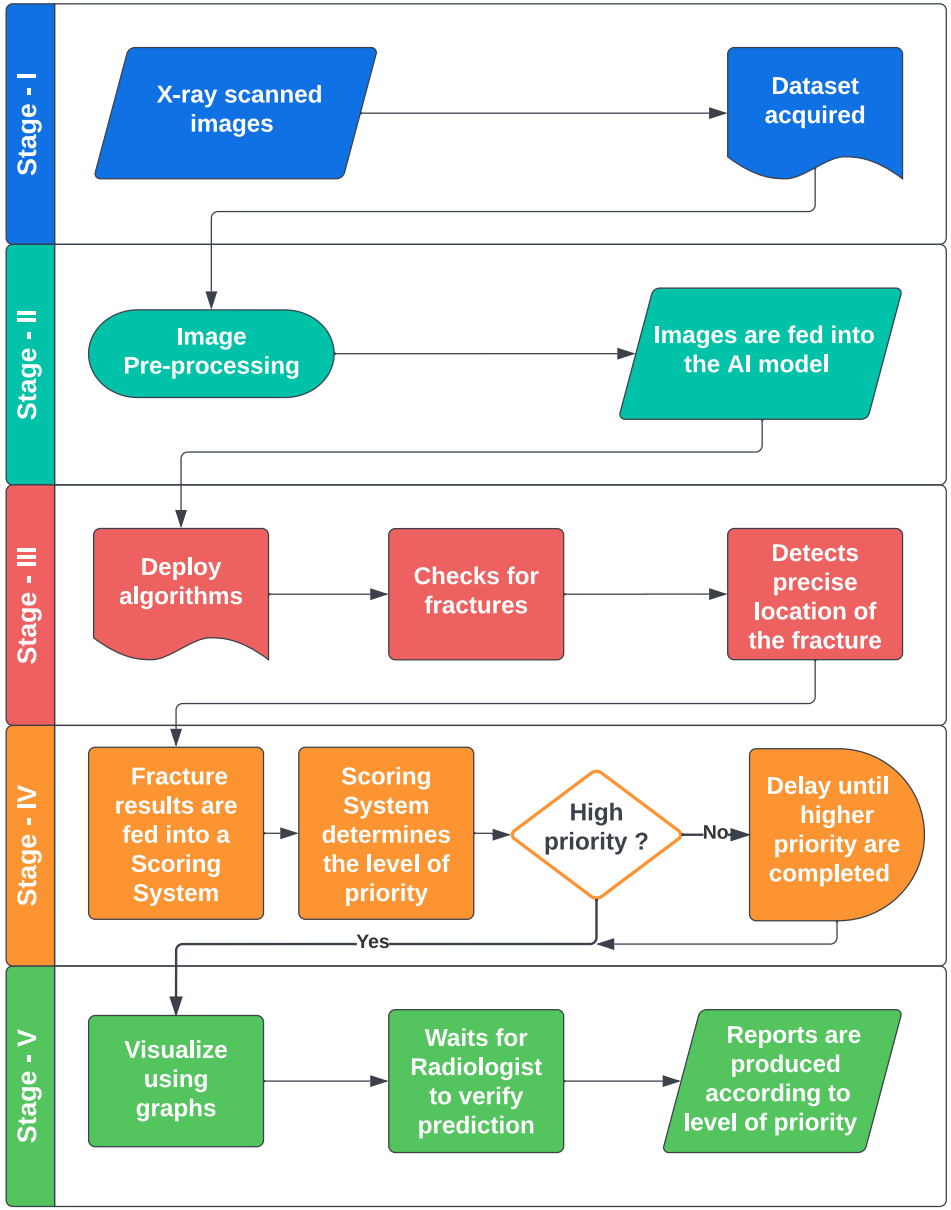
2 - CNN based Object Detection

3 - Dual-Stage Object Detectors

- Faster R-CNN
- FPN (Feature Pyramid Network)

4 - Single-Stage Detectors

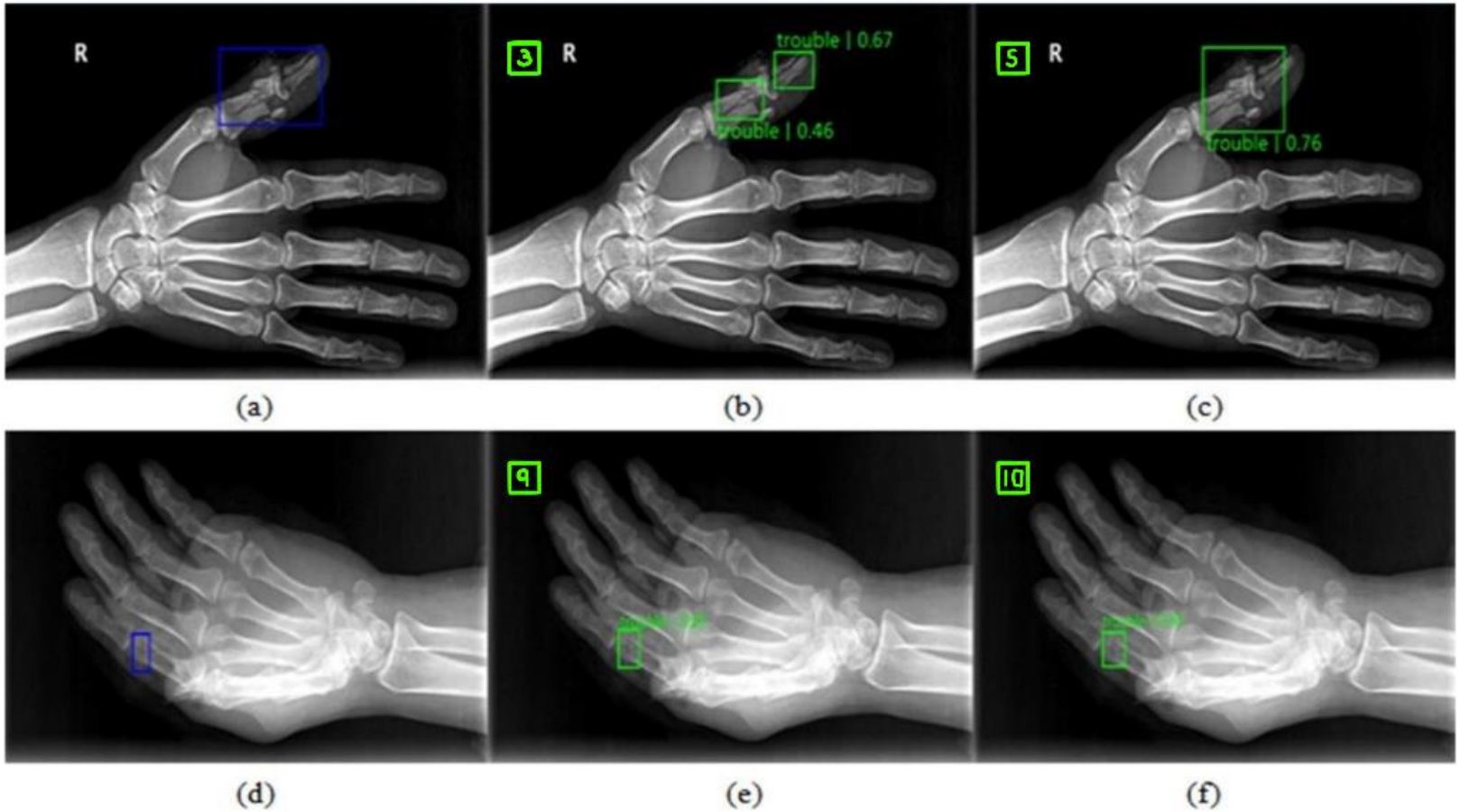
- YOLOv4
- RetinaNet



Methodology & Implementation

Results & Future Plans

Example Output :



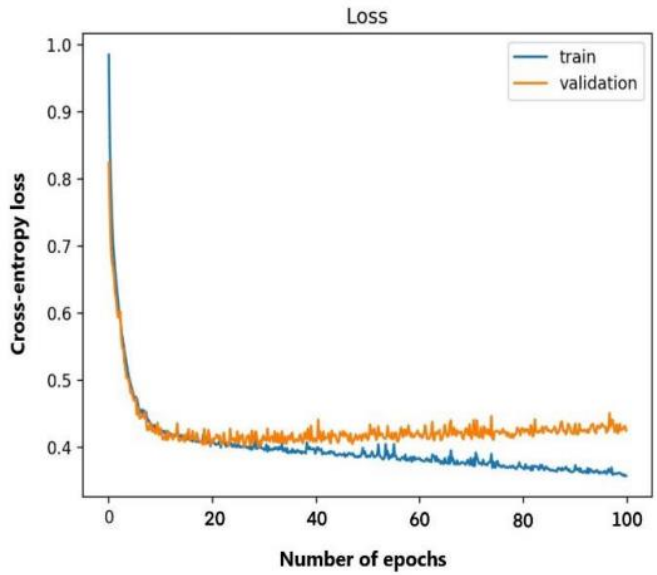
Results & Future Plans

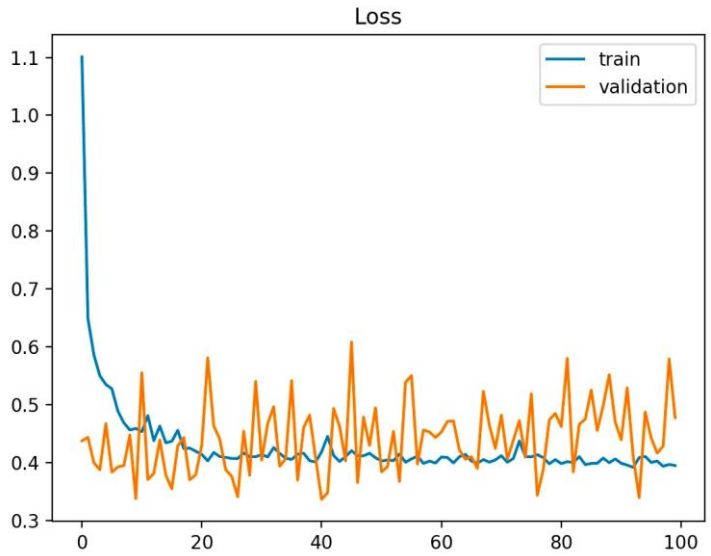
- YOLO algorithm seems to be best fit for model training for this project
- Confidence score table below
- YOLO has consistently better performance than the other models

Fractures	Models			
	RetinaNet	YoloV4	Faster R-CNN	FPN R-CNN
Finger	0.8634	0.9167	0.9027	0.901
Hand	0.8725	0.9341	0.8929	0.8934
Shoulder	0.8432	0.9001	0.9102	0.9023
Elbow	0.8345	0.8643	0.8592	0.8447
Pelvis	0.8238	0.8592	0.8513	0.8492
Chest	0.8323	0.8542	0.8482	0.8312

Results & Future Plans

- Training-validation loss Graphs for model training

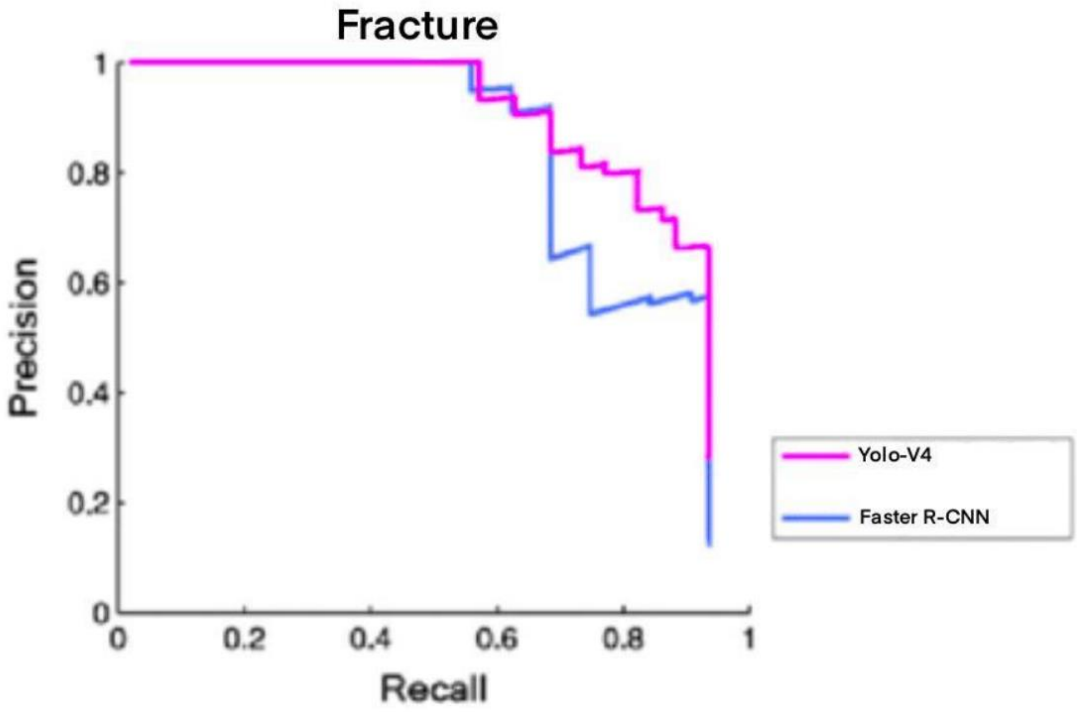




- Yolo (Left) lowest loss for both the validation and training dataset compared to FPN (On the right)

Results & Future Plans

- Precision-recall curve
- Yolo-V4 & Faster R-CNN
- YOLO is outperforming faster R-CNN
- YOLO maintains better balance between precision and recall



Results & Future Plans

1) Help high-end hospitals to clinics, and Radiology centers
2) This model will work as a second pair of hands for the Radiologist
3) Decrease the time taken to produce reports
4) Detects and organizes the scanned X-rays according to their priority
5) Further improvements by adding AI aided report generation

Learning & Feedback

Learning

- Helped me analyze the implications of applying AI systems to Healthcare
- Develop better and efficient methods to help people and the healthcare industry
- It would be great if this model were to be implemented across all Medical centers and make it affordable to both the centers and the general public
- This project helped me be a better team worker and helped me be more consistent throughout the project to meet the deadlines

Feedback

- This event was very systematic, organized and insightful
- Great educational experience and It took some work, but I appreciate the opportunity to push myself.

Thank you