Fracture Detection in X-ray Images Using Object Detection Algorithm

Submitted by

K.M SABIT

ID:183-35-2583

Department of Software Engineering

Daffodil International University

Supervised by

Musabbir Hasan Sammak

Lecturer

Department of Software Engineering

Daffodil International University

This Thesis report has been submitted in fulfillment of the requirements for the Degree of Bachelor of Science in Software Engineering

APPROVAL

This thesis titled on "Fracture Detection in X-ray Images Using Object Detection Algorithm", submitted by **K.M. SABIT** (ID: **183-35-2583**) to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.

BOARD OF EXAMINERS

Chairman

Dr. Imran Mahmud
Head and Associate Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

Internal Examiner 1

Md. Shohel Arman
Assistant Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

Internal Examiner 2

Khalid Been Badruzzaman Biplob
Lecturer (Senior)
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

External Examiner

Md. Tanvir Quader
Senior Software Engineer Technology Team
a2i Programme

DECLARATION

It at this moment declares that I have done this thesis under the supervisor of Musabbir Hasan Sammak, Lecturer Department of software Engineering , Daffodil International University. It is stated that neither this thesis nor any part of it has been submitted to any other university to receive a degree.

K.M.SABIT

Student ID:183-35-2583

Batch:27

Department of software Engineering

Faculty of Science & Information Technology

Daffodil International university

Musabbir Hasan Sammak

Lecturer

Department of software Engineering

Faculty of Science & Information Technology

Daffodil International university

ACKNOWLEDGEMENT

First I express my heartiest thanks and gratefulness to almighty Allah for His divine blessing to make me possible to complete this thesis successfully.

I feel grateful to my profound indebtedness to **Musabbir Hasan Sammak**
Lecturer at the Department of Software Engineering at Daffodil International University, Deep knowledge & keen interest of my supervisor in the field of image processing and deep learning based application influenced me to carry out this thesis. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this thesis.

I would like to express my heartiest gratitude to Dr. Imran Mahmud, Head In-Charge of the Software Engineering faculty for his kind help to finish our project and also to other faculty members and the staff of the SWE department of Daffodil International University.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

Bone fractures are a common medical issue and the patient suffer a lot and it is so painful . The majority of the time as a result of pressure put on it from an accident, practicing sports, or other causes .Many prominent hospitals in Bangladesh invest a lot of money each year on X-ray machines, radiologists, and medical personnel to enhance patient care. After taking x-ray of the fracture the doctor and radiologist detect the fracture manually. For that reason many many doctors and radiologist miss small fracture or hair line fracture and give patient wrong treatment and for this wrong treatment patient suffer a long time .

Many modern scanners can create digital radiography picture excellent detailing and resolution. But we cannot thinking to improve the current way of diagnosis. we may use the huge amount of data with high quality and resolution to apply some computer vision technique to speed up the detection process .

My object is to analyze medical x-ray images using object detection algorithm, and I use YOLO V:7 for object detection .Yolo v7 is faster object detection algorithm because YOLO V7 use end to end Neural Network it makes predictions of bounding boxes and class probabilities all at once.

YOLO uses a single fully connected layer to carry out all of its predictions. it is the fastest and most accurate real-time object detector to date.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

1. INTRODUCTION

1.BACKGROUND:

Bone fracture is a painful injuries where cause by strong force hitting your bone or your body.it usually happened when you fall , any car accident, or bike accident or sport injuries but the main difference is how badly your bon are damage .but some time your bone may weak for some desires like osteoporosis cancers, or ontogenesis imperfect etc.in those cases bones are so weak and normal pressure can break the bone.

In Bangladesh every year 350000 to 400000 patient goes in a hospital for bone injuries and fracture and they spend lots of money for their treatment. And the treatment cost increasing every year .To seeing the number of bone fracture in a medical condition that is most common that we can imagine.

Some cases bone fracture can easily identified to see the x-ray images but some cases it is not so easy to detect where the fracture is not even expert radiology's . Some cases expert doctors can not detect the bone fracture or doubts about the bone fracture because some bone fracture are in Spine or hair line fracture .That detection can not be so easy for human eye.
In our Bangladesh all doctor use x-ray film paper and x-ray view box to see the bone condition. For that reason some doctor did not catch the hair line fracture
In our Dhaka Bangladesh highest fracture treatment cast is 235,000 Taka .
Many patients get bone fracture and come to Dhaka for the better treatment because availability of higher qualified orthopedic doctor in Dhaka .Experience bone Fracture surgeons practice in Dhaka and also highest bone fracture surgery success rate in Dhaka. That's not mean the highly qualified doctor lives in Dhaka but the number of other cities not more then Dhaka.

Bones are the solid organs in the human body .Bones protect many important organs such as heart , lungs etc. A human body have 206 bones with different types of shape some are flat some are long some are short. The largest bone is femur .Bone fracture is a common problem .There are so many types of bone fracture but in Bangladesh doctors classified Three types of bone fracture simple fracture complex fracture and compound fracture .simple fracture is bone is broken but bones are in a same place. In Complex fracture bone is broken into some pieces .Last one is compound in compound fracture bone is broken and move to its place or visible through the skin . in our country mainly bone fracture patient is 15 to 25 years old and 45 to 60 or more then that . There are so many patient comes for low bone density they are mainly women's .

In our Bangladesh there is a wide range of fracture patient but main problem is lack of good doctors and radiologist. In order to assist them attain greater performance accuracy and save time waste, we must develop some sort of support system.
So, for classifying fracture from images deep learning is a very popular method. Why classification technique is important? Because it is very important to teach a model which one is a bone fracture and which is not. What type of fracture is it? One can get all the question-answer from these questions. In a standard classifying format, there have many types of fracture . All of these Bone fracture types are classified with different class names Simple fracture, complex fracture and compound fracture

Body Type	detail	Class
Only Human body	Hand	Simple fracture
		Complex fracture
		Compound fracture
	Leg	Simple fracture
		Complex fracture
		Compound fracture

TABLE 1: Classification of Fracture

1.1 MOTIVATION OF THE RESEARCH

Bone fracture is painful .patient goes to radiologist for x-ray image and detect the fracture but some time doctors or radiologist could not detect the fracture properly and give wrong treatment to the patient for that reason patient suffer so much and some cases patient lost their hand or leg for the wrong treatment.

Detecting fracture is time consuming. If there have system for the automated fracture detection it helps to detect the fracture faster and it helps a doctor to take decision faster .in covid19 situation the similar type of automated system use chest x-ray images for detecting is the patient have covid19 or not .

By inspire that we have to think of making a system that will detect bone fracture using x-ray images .Bangladesh is high populated country and bone fracture is a common .It's also helps new pass out orthopedic doctor to detect the right position of bone fracture and it will be time consuming

1.2 PROBLEM STATEMENT

We know that bone fracture is a painful for human body.
Early many works on x-ray image detection. Many researcher works on different type of algorithms like Deep Convolutional Neural Network ,CNN,R-CNN and many more. Many researcher detect only detect chest x-rays and applied SVM ,Random Forest ,Decision Tree and many more. They collect data from different hospital some use Global data which is available. Researcher applied there own country data. I collect data from a pathology lab in my home town because medical data is confidential no one lab or hospital did not want to give there medical data. For that reason those type of data collection is painful and time consuming .

1.3 RESEARCH QUESTIONS

The research question is

Q1: Which model performs better for detecting bone fracture?

Q2: Which model gives faster result?

1.5 RESEARCH OBJECTIVE

The main objective is to detect the fracture and fracture type and its helps doctor to take faster decision to which treatment is better for the patient . Also wanted to get a better result so that our model can be more applicable. Our thesis goes are:

- Creating an automated system.
- For creating a low-cost system that is affordable for a developing country like Bangladesh.
- Detect fracture and fracture type

1.4 RESEARCH SCOPE

Research's main scope is :

- Want to develop a method on basic x-ray dataset and that can detect fracture from human body
- It will help our country new pass out doctor to detect the exactly where the bone fracture is. And it will be low cost for that every hospital will use the system .

1.5 THESIS ORGANIZATION

I discuss human bone fracture in the first chapter, including the many types of bone fracture, how the system will operate and benefit patients and physicians in particular, as well as the motivation for the work and the history and goals of the study.

The literature review will be covered in the next chapter.

The technique that certain researchers utilize and the locations where they use their systems are shown in the literature review.

I will also talk about my work and how the approach operates in the third chapter. I'll go through data gathering, data preparation, and an analysis of our work. The technique and results are covered in the fourth chapter, and I provide a conclusion and explain our work in the last chapter.

CHAPTER 2

2. LITERATURE REVIEW

2.1 INTRODUCTION

In literature review researcher reviews the previous work, research ,conference paper ,book etc. In literature review people can find what work has already done on this topic .summarize the hole topic .findings lacking after that finding work limitation and how to overcome from the limitation and finally get good result

2.2 PREVIOUS LITERATURE

Bone fracture is very much painful. When people accidentally damage or fracture their bone they suffer a long time some time they have to cut their hand or legs. The idea automatic bone fracture detection. It will help the doctor to find out the correct Bone fracture position and fracture type .on bone fracture detection many researcher already done their research and apply many type of machine learning algorithm to detect and classify the bone fracture. For my work I have only focused bone fracture detection part.

Yee Liang Thian and et al [1] the paper name is Convolutional Neural Networks for Automated Fracture Detection and Localization on Wrist Radiographs . In this paper Author used Inception-ResNet Faster R-CNN architecture to implemented as a deep learning model to detect bone fracture. The author collect data from hospital picture archiving and communication system. This paper limitation is they detect only radius ulna bone fracture but did not detect other bone fracture like carpal or metacarpal Bone fracture.

Waseem Abbas and et al [2] the paper name is Lower Leg Bone Fracture Detection and Classification Using Faster RCNN for X-Rays Images. In this paper author used R-CNN VGG-16 to detect the bone fracture . they collected data from BVH Bahawlpur Victoria hospital from different 50 patients of bone fracture. This paper main limitation is small data set they collect only 50 patient data

Hui-ZhaoWu and et al [3] the paper name is The Feature Ambiguity Mitigate Operator model helps improve bone fracture detection on X-ray radiograph. Author used ResNeXt+FPN CNN R-CNN. They collect data from Hospital of Hebei Medical University projection views were drawn from the pictures archiving and communication system.This paper limitation is the image had to be resized to 256x256 resolution smaller from the original size for that reason small fracture and hair line fracture is undetectable .

D.H. Kim and et al [4] the paper name is Artificial intelligence in fracture detection: transfer learning from deep convolutional neural networks .author used only CNN methodology for detecting bone fracture . author collected data set from National Health Service (NHS). The training picture and testing image in this article were both based on the evaluation of a human radiologist, which meant that the model could never surpass the human.

Bin Guan and et al [5] the paper name is Thigh fracture detection using deep learning method based on new dilated convolutional feature pyramid network . They used DCFPN Fast R-CNN Feature pyramid network (FPN) Convolutional neural networks (CNN). They collect their data from the Department of Radiology of Linyi People's Hospital .The limitation is authors model can not avoid some false prediction output .and few fracture can not be detected correctly by their algorithm

Saranya and et al [6] the paper name is A survey on bone fracture identification techniques using quantitative and learning based algorithms .In this paper author used CNN model GAP Model R-CNN for his data set . In this paper author collect data from the hospital using IOT devices .in this paper author did not collect the over weighted patient bone fracture data

Linyan Xue Weina and et al [7] the paper name is Detection and localization of hand fractures based on GA_Faster R-CNN. In this paper author used GA_Faster R-CNN for detecting patient bone fracture. They collect from hand fracture X-ray images from the department of orthopedic surgery at the Affiliated Hospital of Hebei University. Author used only patient hand fracture data they did not detect other parts fracture x-ray image

L.Jagjeevan Rao and et al [8] the paper name is Advanced computerized Classification of X-ray Images using CNN . Author used in this paper BPNN K-Means Clustering ,CNN, M3 filter algorithm to detect the bone fracture . author collected data set from Apex diagnostic centre, Visakhapatnam. The system gives better results for the computer based classification of X-ray images. The proposed methodology with a combination of better filtering, segmentation, feature extraction and classifiers gives the better result.

Feng Yanga and et al [9] the paper name is Computer-Assisted Bone Fractures Detection Based on Depth Feature . In this paper author used CNN,,Alexnet,PCA,SVM,ELM,RF algorithm to detect the fracture .For this paper author collect data from MURA . it is currently the largest open source medical radiographic data set .the limitation is many shoulders x-ray images and humerus x-ray images are not clear and many unclear images are used doer dataset

Payman Hussein Hussan and et al [10] the paper name is Design of a Fracture Detection System based on Deep Program in a Convolutional Neural Network in this paper author used GP-based CNN SVM .They collect data from Stanford hospital's picture archiving and communication system and MURA data set .when they use mura data set x-ray image the presence of noise and the dark background of the images. They used unclear data set for train the algorithm

Fırat Hardalaç and et al [11] Fracture Detection in Wrist X-ray Images Using Deep Learning-Based Object Detection Models in this paper author use SABL, RegNet, RetinaNet, PAA, Libra R-CNN, FSAF, Faster

R-CNN, Dynamic R-CNN and DCN for detecting bone fracture .They collect data from Gazi University Hospital's dataset the main limitation is data and they detect only wrist X-ray images .

Josep de Cid Rodr´ıguez [12] the paper name is Fracture detection from X-Rays with Deep Learning the author use CNN for Detectibg bone fracture from xray images .the main problem is There aren't many publicly available radiological imaging datasets that are big enough to get findings that are good.

MAHMOUD AL-AYYOUB and et al[13] the paper name is Determining the Type of Long Bone Fractures in X-Ray Images. WSEAS TRANSACTIONS on INFORMATION SCIENCE and APPLICATIONS .Uthor collect only 300 data they use filtering algorithm to reduce noise from data

Oishila Bandyopadhyaya and et al[14] the paper name is Arindam Biswasa, Bhargab B. Bhattacharya. (2015)Long-bone Fracture Detection in Digital X-ray Images Based on Digital-Geometric Techniques .The author use digital geometry for detecting fracture .they collect data from medical image database (MD) .data from online maximum data are so noise .

CMAK Zeelan Basha and et al [15] The paper name is An Effective and Reliable Computer Automated Technique for Bone Fracture Detection. EAI Endorsed Transactions. The author use (SIFT) and back propagation neural network for detecting fracture .The author use nearly 300 images.

Tanushree Meena and et al [16] the paper name is Bone Fracture Detection Using Deep Supervised Learning from Radiological Images: A Paradigm Shift .the author use CNN .collect data from Picture Archiving and Communications Systems .

YanglingMa and et al [17] the paper name is Bone fracture detection through the two-stage system of Crack-Sensitive Convolutional Neural Network .the author use CNN R-CNN for bone fracture detection .the author use total of 1052 images and they collect data from X-ray images from Haikou People's Hospital .

Author information and et al [18] the paper name is Femoral neck fracture detection in X-ray images using deep learning and genetic algorithm approaches .the author use CNN for detect bone fracture .the author collect 65 individuals provided a total of 234 frontal pelvic X-ray pictures.the main limitation is they collect only femoral neck fracture data they did not collect other fracture data

Dhirendra Prasad Yadav et al [19] the paper name is Hybrid SFNet Model for Bone Fracture Detection and Classification Using ML/DL .In this paper author use CNN Hybrid SFNet model for detect bone fracture. collect data from hospit

Dr.S.N.GeethaJakshmi et al [20] the paper name is MUL TIPLE CLASSIFICATION SYSTEM FOR FRACTURE DETECTION IN HUMAN BONE X-RAY IMAGES .The author used KNN and SVM for bone fracture detection .the author used the x-ray pictures were used to extract two different kinds of features, namely texture features and shape features, for a total of 12 features.

Hoai Phuong Nguyen et al[21] the paper name is A deep learning based fracture detection in arm bone X-ray images.In this paper author use YOLO V4 and faster R-CNN and they find 81 % accuracy they use large data set for training.

Yu Cao et al [22] FRACTURE DETECTION IN X-RAY IMAGES THROUGH STACKED RANDOM FORESTS FEATURE FUSION .The author propose a new method of stacked random forests for feature fusion. The author proposed method on a set of 145 X-rays. They capture 81.2% from their model

BinGuan et al [23] the paper name is Arm fracture detection in X-rays based on improved deep convolutional neural network. The author use two-stage R-CNN method. They employed about 4,000 arm fracture X-ray radiographs from the MURA dataset..

Shuzhen Lu et al[24] Automated universal fractures detection in X-ray images based on deep learning approach. They used modified Ada-ResNeSt backbone network and the AC-BiFPN detection method.and they collect data from MURA data set.

Bin Guan et al[25] Thigh fracture detection using deep learning method based on new dilated convolutional feature pyramid network.Author used dilated convolutional feature pyramid network (DCFPN).they collect data from Linyi People's Hospital. They found 82.1% from their model

Bin Guan et al[26] Automatic detection and localization of thighbone fractures in X-ray based on improved deep learning method. Author used ResNeXt and 3842 thighbone X-ray images .The model reaches 88.9%.

Changhwan Lee et al[27] the paper name is Classification of femur fracture in pelvic X-ray images using meta-learned deep neural network and author used encoder-decoder structured neural network.they found accuracy of 86.78% accuracy .

Yang Jia et al[28] An attention-based cascade R-CNN model for sternum fracture detection in X-ray images.The author used R-CNN, YOLOv5 and they found mAP of 0.71 from R-CNN .its better then the YOLO V5

Shaghayegh Shahiri Tabarestani et al[29] Bone Fracture Detection and Localization on MURA Database Using Faster-RCNN. The author used Faster-RCNN for detect .They collect data from MURA database.They found mAP=66.82 % for IOU=50%.

LinyanXue et al [30] Detection and localization of hand fractures based on GA_Faster R-CNN.

Author used GA_Faster R-CNN.they found from model 97%–99% accuracy .

2.3 CONCLUSION

From the previous literature resource used many types of algorithms models. They used those model for a good result. They used Faster-RCNN, GA_Faster, YOLOv5, R-CNN,encoder-decoder structured neural network, ResNeXt, YOLO V4.They trying to show that their model accuracy.

They collect data from different hospital archiving system or they try to collect online based data sets. MURA is online based radiology and medical data sets .Some Author uses 50 bone fracture images some used 300 x-ray images some author used only long bone fracture data some used only hand fracture data and some author used only women bone fracture x-ray data. They try to get better accuracy from there models. I found in some paper they get 88.9% accuracy .some author get 98% to 99% accuracy from their model but the other hand few author did not satisfied from their result because they collect data from online based datasets and online based datasets picture are not good quality for that reason there model did not detect small bone fracture from their images.

They applied feature extractions, augmentation, annotation, and many more techniques. For better accuracy and real-time performance. In our work, we also tried to Detect the Bone fracture from patient x-ray images using YOLO V7 object detection algorithm for better accuracy

CHAPTER 3

3 .RESEARCH METHODOLOGY

3.1 RESEARCH METHODOLOGY

We have applied YOLO V7 for our work. We used YOLO V7 because YOLO V 7 is new and it is faster from the other object detection algorithm and it gives better accuracy from the other object detection algorithm .That's why we chose YOLO V7 For our data sets.

3.2 DATA COLLECTION

In the internet there have many open source data side for medical radiographic data set MURA is the open source medical radiographic data set. Those data set collected from many countries hospital .but main problem is the maximum data are not so clear some data are low regulation for that reason . for that reason I collect data set from Padma Lab And Consultation center Joypurhat Bangladesh.

Figure 1:all type fracture sample

3.3 DATA PREPROCESSING

I collect data from Padma lab and consultation center Joypurhat Bangladesh .First I collect 500 x-ray fracture data from x-ray view box but maximum data are unclear for that reason I have to collect data from Padma lab and consultation center X-ray archive. From that I collect 350 x-ray images , after that I use makesense.ai for annotated all those x-ray image data and labels those x-ray data .All the value are store as YOLO format. After that I have to divide data into train and validation data sets .in training data sets I have to put 80% Of data and validation set I have to put 20% of data .

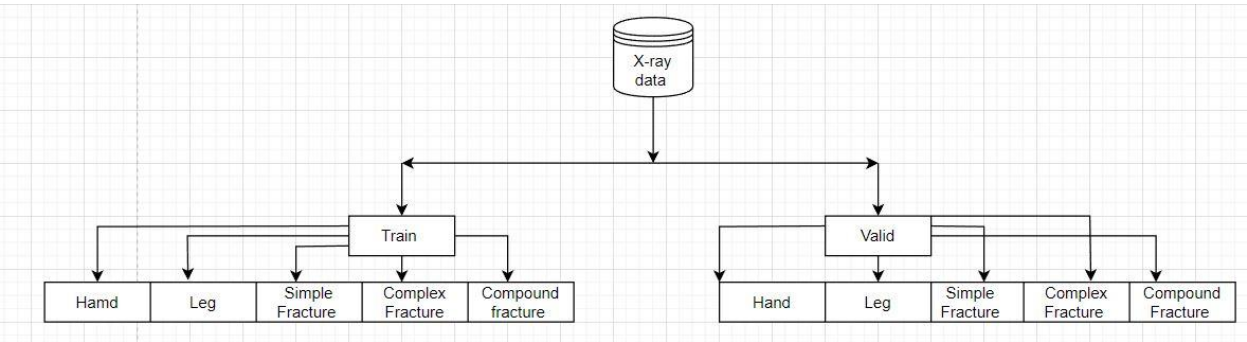


Figure 2 : Data labeling

3.4 CONVOLUTIONAL NEURAL NETWORK (CNN)

One of the most popular neural network is Convolutional Neural Network .it first used in 1980.At that time CNN used for recognized hand written digits and it used postal sectors to read zip code, pin code .any deep learning model it requires a huge amount of data For train the model .convolution neural network has three layers one is convolutional layers, pooling layers and fully connected layer .In convolutional layers input layer neurons connected to the hidden layer . Pooling layers for reduce dimensionality from feature map . Last one is Fully connected layer it is for flatten and fed into the fully connected layer.

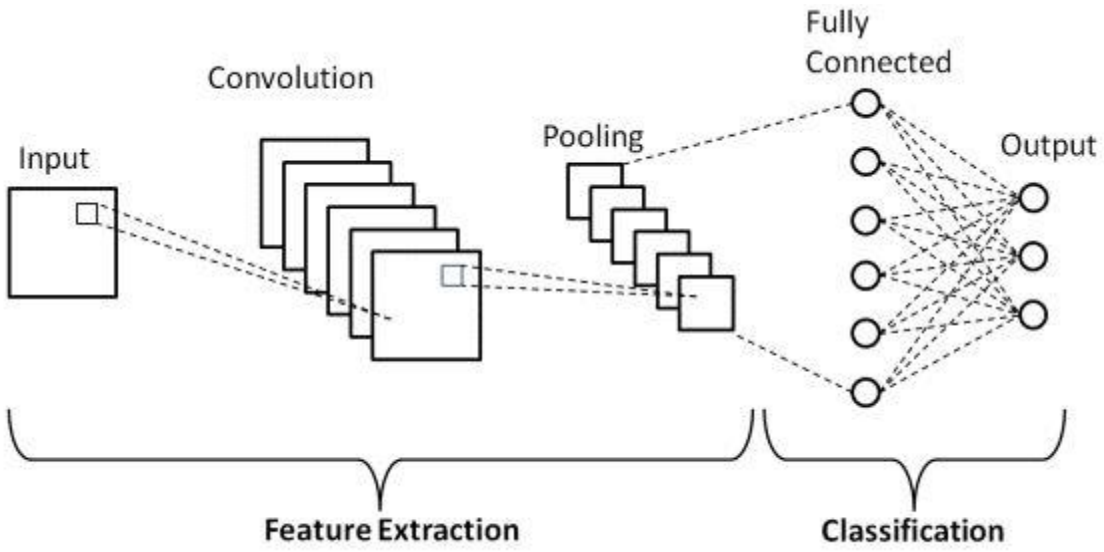


Figure 3:CNN basic architecture

3.4 YOLOv7

For my work I applied YOLO V7 .YOLO is a algorithm that use neural network to detection real time object .This is so much popular for his speed and accuracy. YLOL (You Only Look Once) that detect various object in a picture .In YOLO object detection work as a regression problem and provide the class probabilities of the detected image . YOLO algorithm work convolutional neural network (CNN) to detect the object .The algorithm requires only single forward propagation through neural network to detect object .that means the all prediction in image as done single algorithm run .The YOLO v7 algorithm architecture is the highest accuracy among the all real time object detection models .Yolo v7 is based on previous Yolo model .Yolo architecture has total 24 convolutional layers with 2 full connected layers at the end

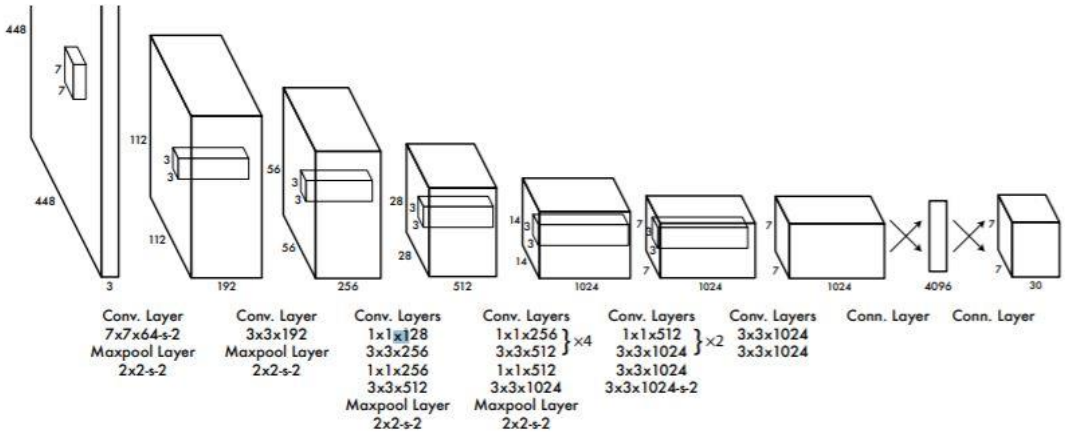


Figure 4: YOLO architecture

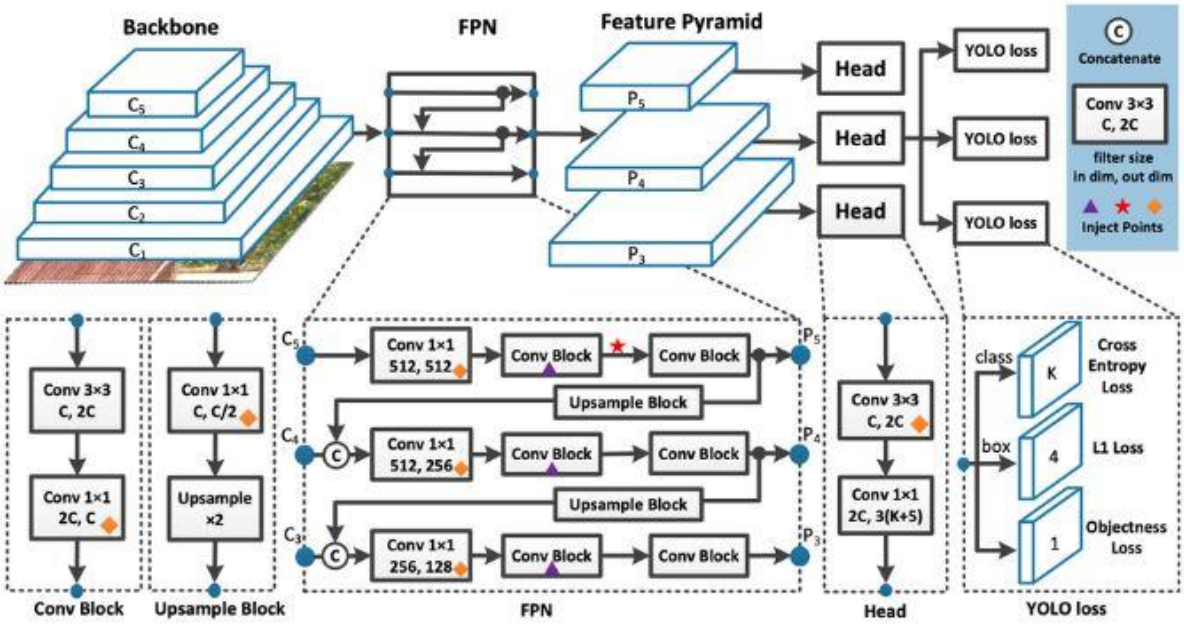


Figure 5: YOLO Architecture diagram

3.5 Evaluation Methods

For evaluation I have to plotted confusion matrix, need the true positive, true negative, false positive, false negative values for evaluation .

True positive is correctly predicted actual value

True negative is correctly rejected value

False positive is incorrectly predicted value is positive

False negative is incorrectly rejected value

3.5.1 Accuracy

Accuracy is a matric that basically describes how model performs all classes .it is important when all model are equally important .it calculate like as the ratio between correct prediction to the total number of prediction

$$Accuracy = \frac{True_{positive} + True_{negative}}{True_{positive} + True_{negative} + False_{positive} + False_{negative}}$$

3.5.2 Precision

Precision measures models accuracy in classifying a sample as positive

$$Precision = \frac{True_{positive}}{True_{positive} + False_{positive}}$$

3.5.3 Recall

Recall measures models ability to detect positive sample the higher the recall more positive sample detected

$$Recall = \frac{True_{positive}}{True_{positive} + False_{negative}}$$

3.5.4 F1 score

The test accuracy measurement is F1 score it use recall and precision to calculate F1 score

$$F_1 = 2 * \frac{Precision * Recall}{Precision + Recall}$$

3.5.5 Mean Average Precision (mAP)

mAP is a matric it use to evaluate object detection models such as YOLO it calculate over recall value 0 to 1

mAP based on sub matric such as Confusion Matrix ,Recall , Precision

3.5.5.1 Confusion matrix

It is for performance measurement in machine learning

True positive: When actual value positive and predicted are also positive

True negative: when actual vale negative and predicted value are negative

False positive: when actual value is negative and predicted value positive

False negative: when actual value positive and predicted are negative.

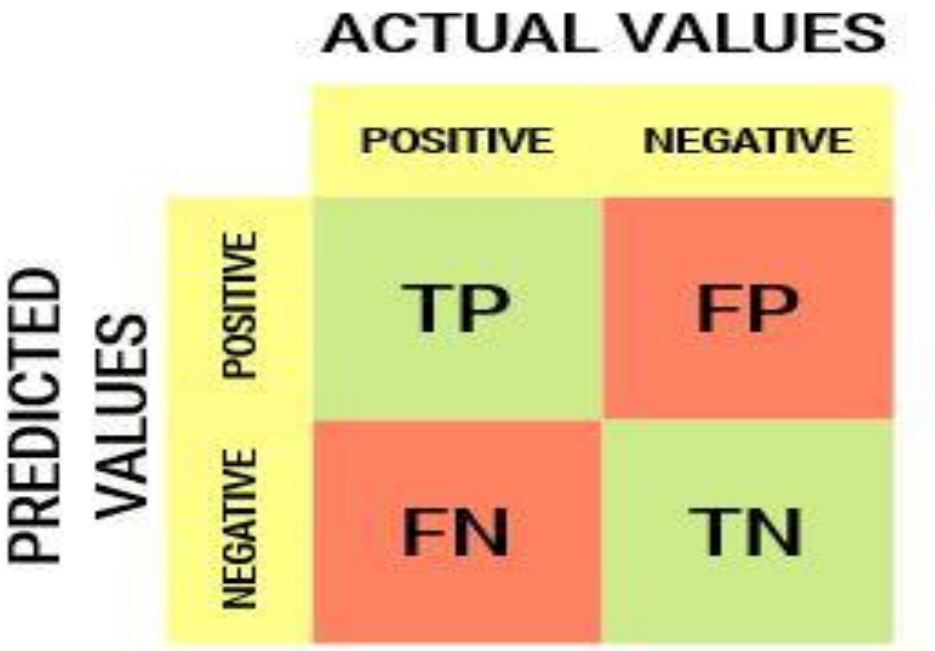


Figure 6: Confusion matrix diagram

3.5.5.2 Intersection over Union (IoU)

An assessment metric called intersection over union is used to assess an object detector's precision on a certain dataset .It is mainly used to object detection where we train a model output a box that fits accurately around the object .if we imagine a green box and a blue box, green box represent the correct box and blue box represent and blur box represent the prediction .When green box and blue box perfectly overlap and its equal to 1

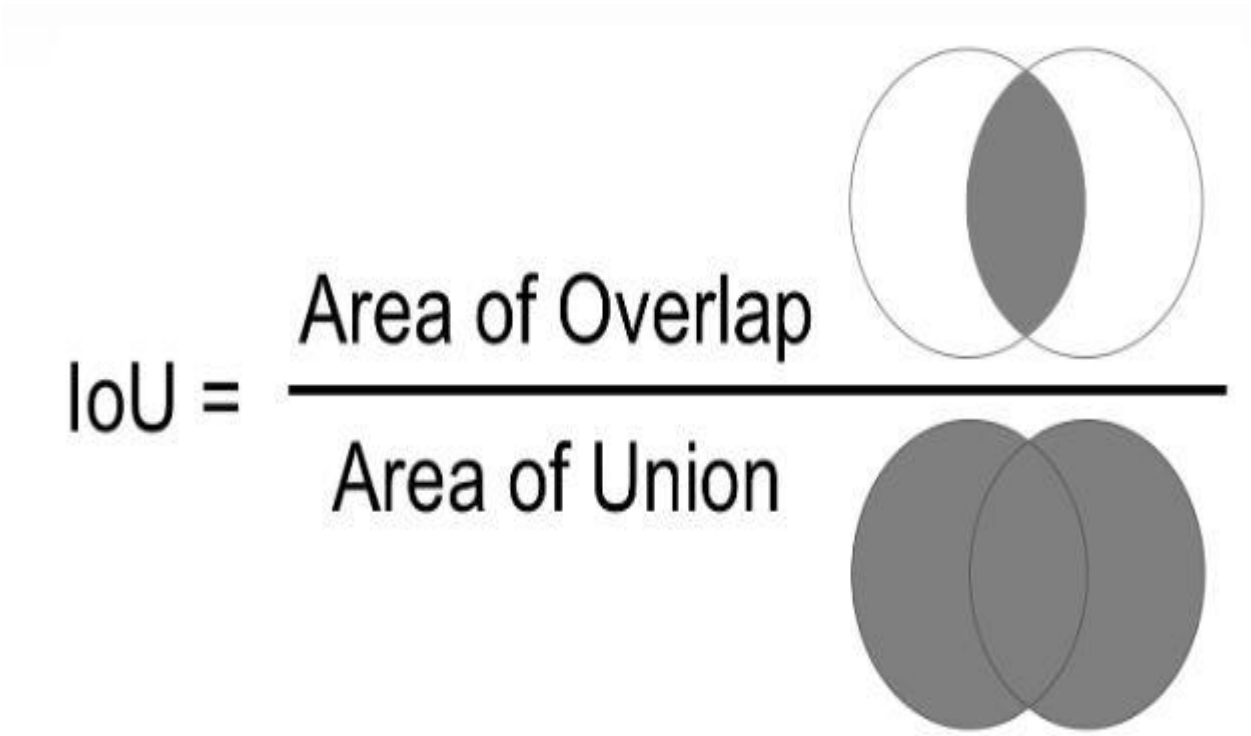


Figure 7: Intersection over Union diagram

CHAPTER 4

4. RESULTS AND DISCUSSION

4.1 INTRODUCTION

The Algorithm of detection human bone fracture is describe already. The data collection and preprocessing part I have describe the model which I have applied for the bone fracture detection. Mow I have describe the result of the algorithm

4.2 RESULT DISCUSSION

after implement YOLO V7 on our data set we got model mAP (Mean Average precision), model accuracy 63%.We run 200 epochs our model predict 77% accurately for all time .For our model we have use only 300 x-ray images and its predict hand and leg data 99% and 94% correctly. For low amount of data our model did not predict simple Complex and compound fracture perfectly. Training Accuracy are compared for gaining the graphs

4.2.1 YOLO V7:

```
  Epoch   gpu_mem      box       obj       cls     total    labels  img_size
199/199     14.2G   0.01656  0.009402  0.001802   0.02776        41       640: 100% 15/15 [00:20<00:00,  1.37s/it]
           Class     Images     Labels          P          R     mAP@.5  mAP@.5:.95: 100% 2/2 [00:02<00:00,  1.39s/it]
             all         57        231      0.778       0.63      0.633      0.395
            Hand         57         51       0.99          1      0.996      0.714
             Leg         57         60      0.945      0.967      0.949      0.742
  Simple_Fracture        57         66       0.67      0.318      0.325     0.0989
 Complex_Fracture        57         31      0.553      0.387      0.377      0.126
Compound_Fracture        57         23      0.733      0.478      0.516      0.295
200 epochs completed in 1.447 hours.
```

Figure 8 : Mapping for YOLO V7

After mapping YOLO V7, we run 200 epochs we have 5classes hand leg Simple fracture complex fracture and compound fracture for all classes all image divide into equal. For all classes we found 231 labels we found precision for all class 77% it shows how correctly predicts for all time.it predict correctly hand data 99% for leg data 94% and For simple, complex and compound fracture it predict 67%,55% and 73%.For Recall is for how accurately our model identify the data for all class its 63% and map@5: for all class 63%.

4.2.2 Confusion Matrix :

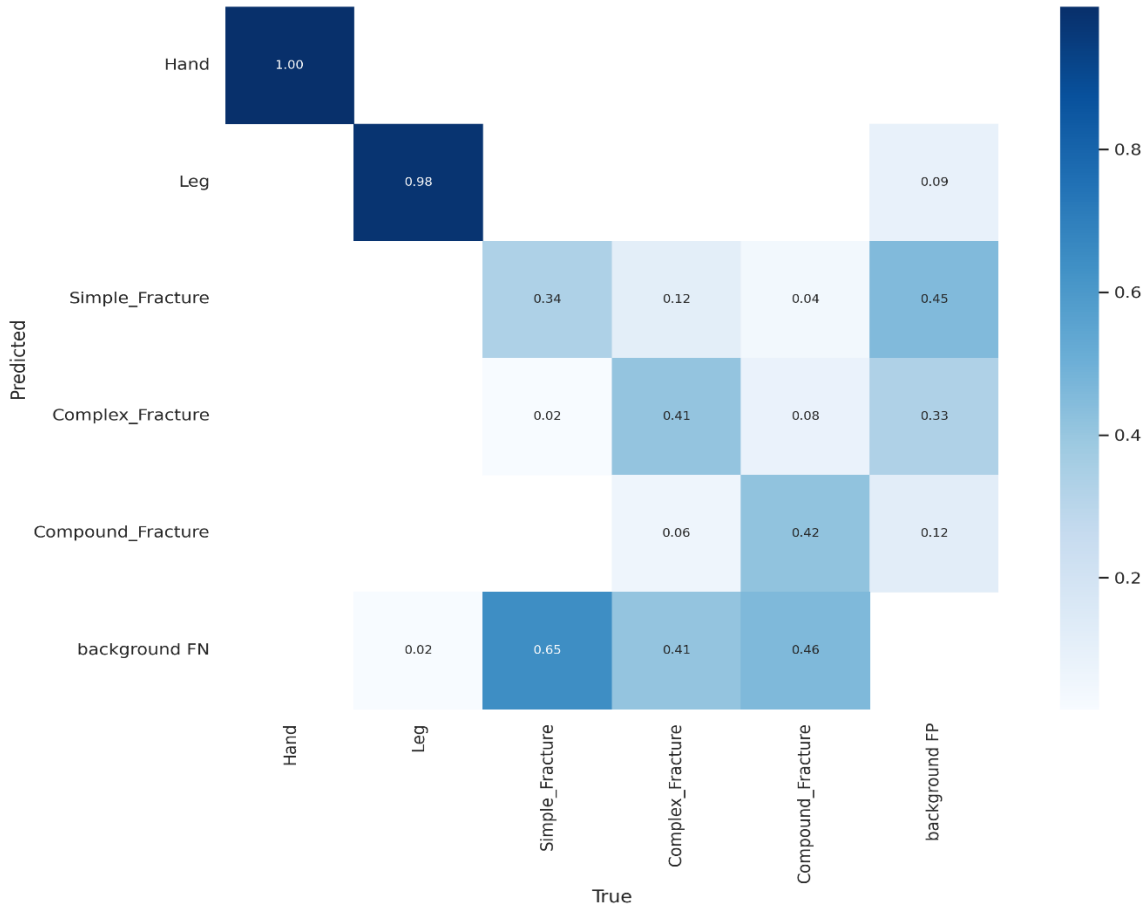


Figure 9: confusion Matrix

After the mapping YOLO v7 generate confusion matrix and its shows that it predict correctly 100% predict hand 98% leg simple fracture 34% complex fracture 41% and compound fracture 46%

4.2.3 Result Graph

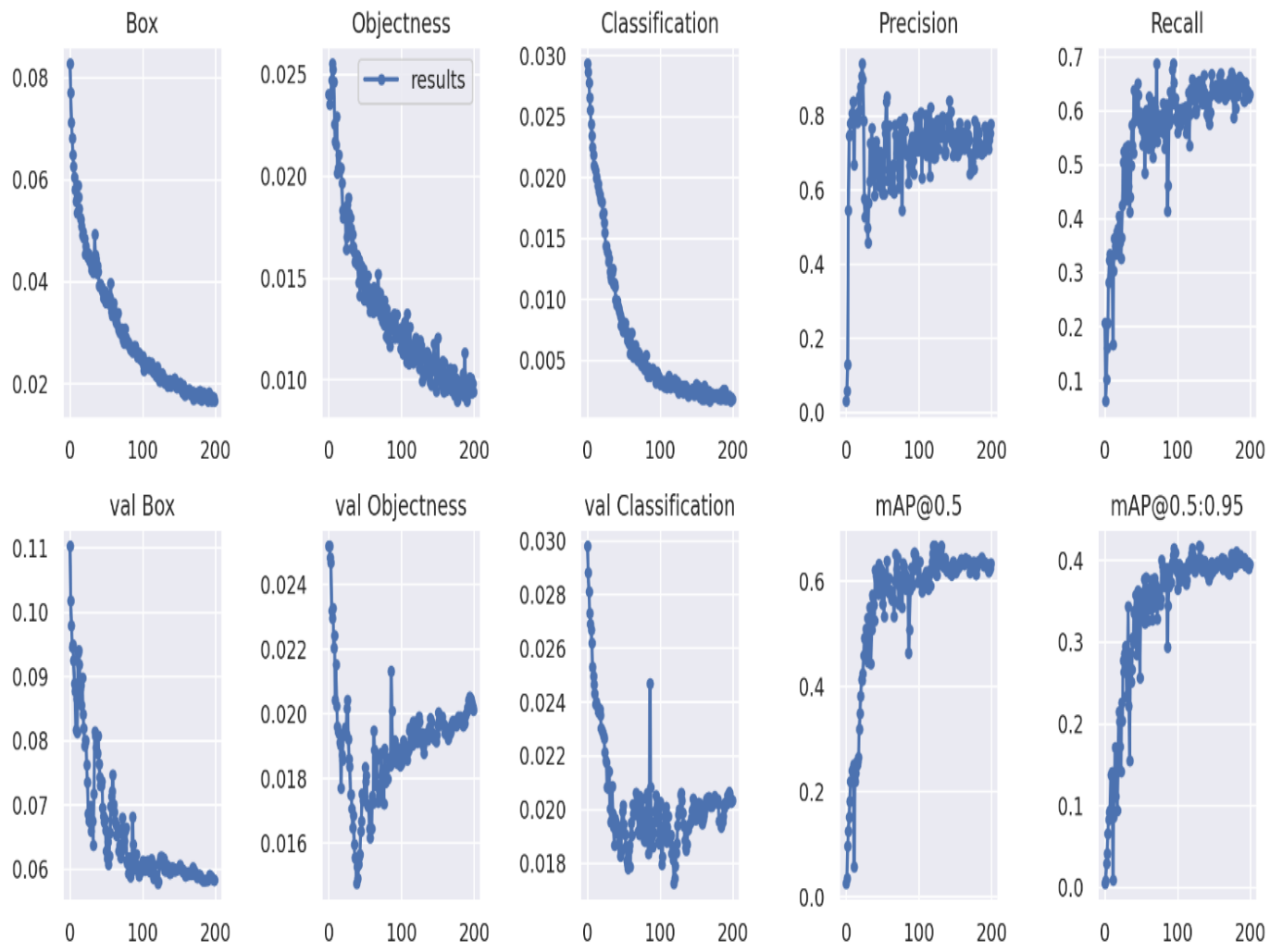


Figure 10:Result Graph

After the mapping YOLO v7 generate result graph its shows how our model run and the model accuracy is up to 60% map 63%

4.2.4 F1 RECALL,PRECISION GRAPH

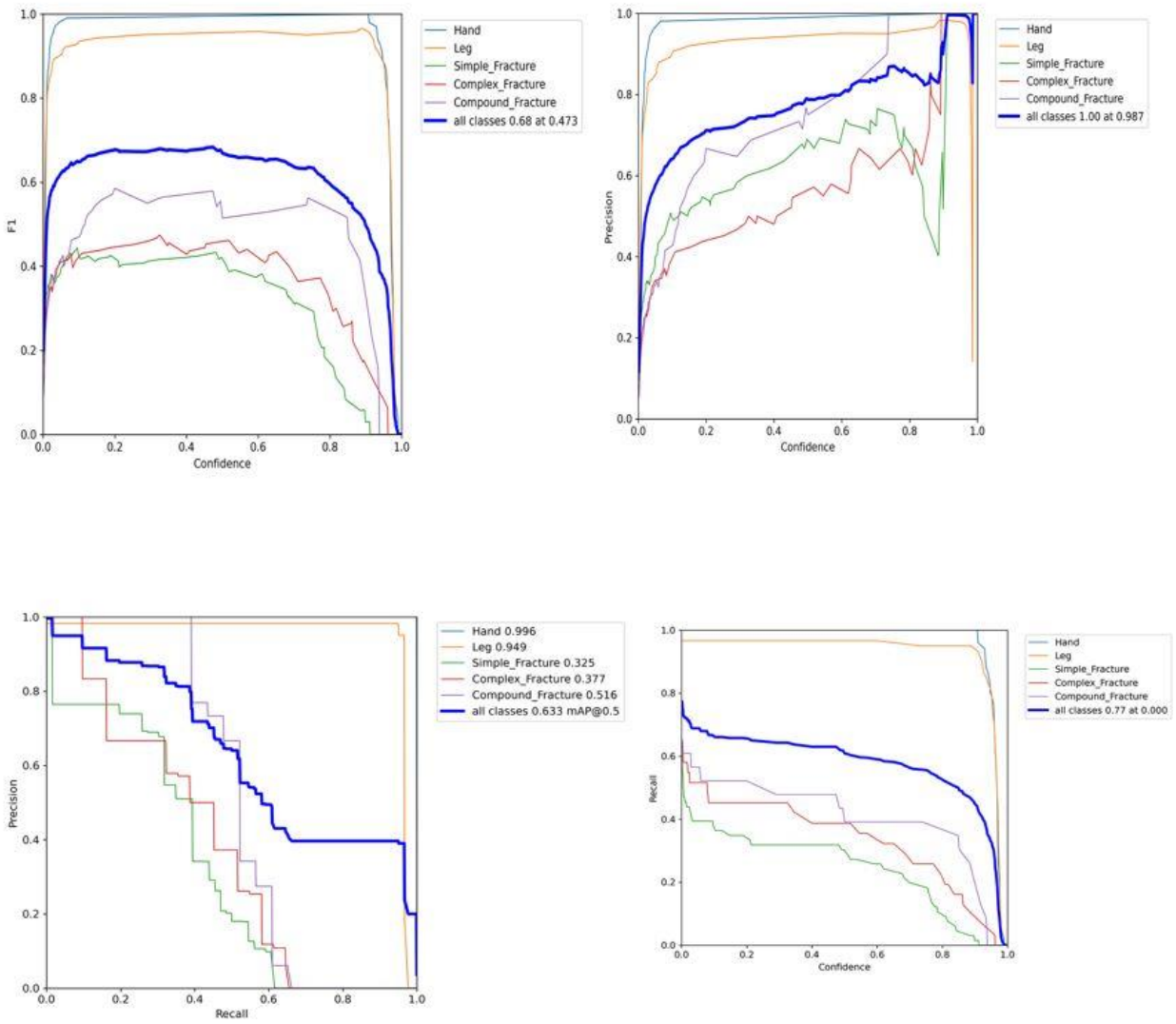


Figure 11: F1, Recall, Precision of YOLOv7

YOLO V7 generate F1, Recell, Precision from F1 graph we found for all class it 68%, for Precision-confidence it 100% at 98% we found 63% , for Precision Recall it 63% and Recall-confidence it 77%.

4.2.5 Output Of YOLO V7:

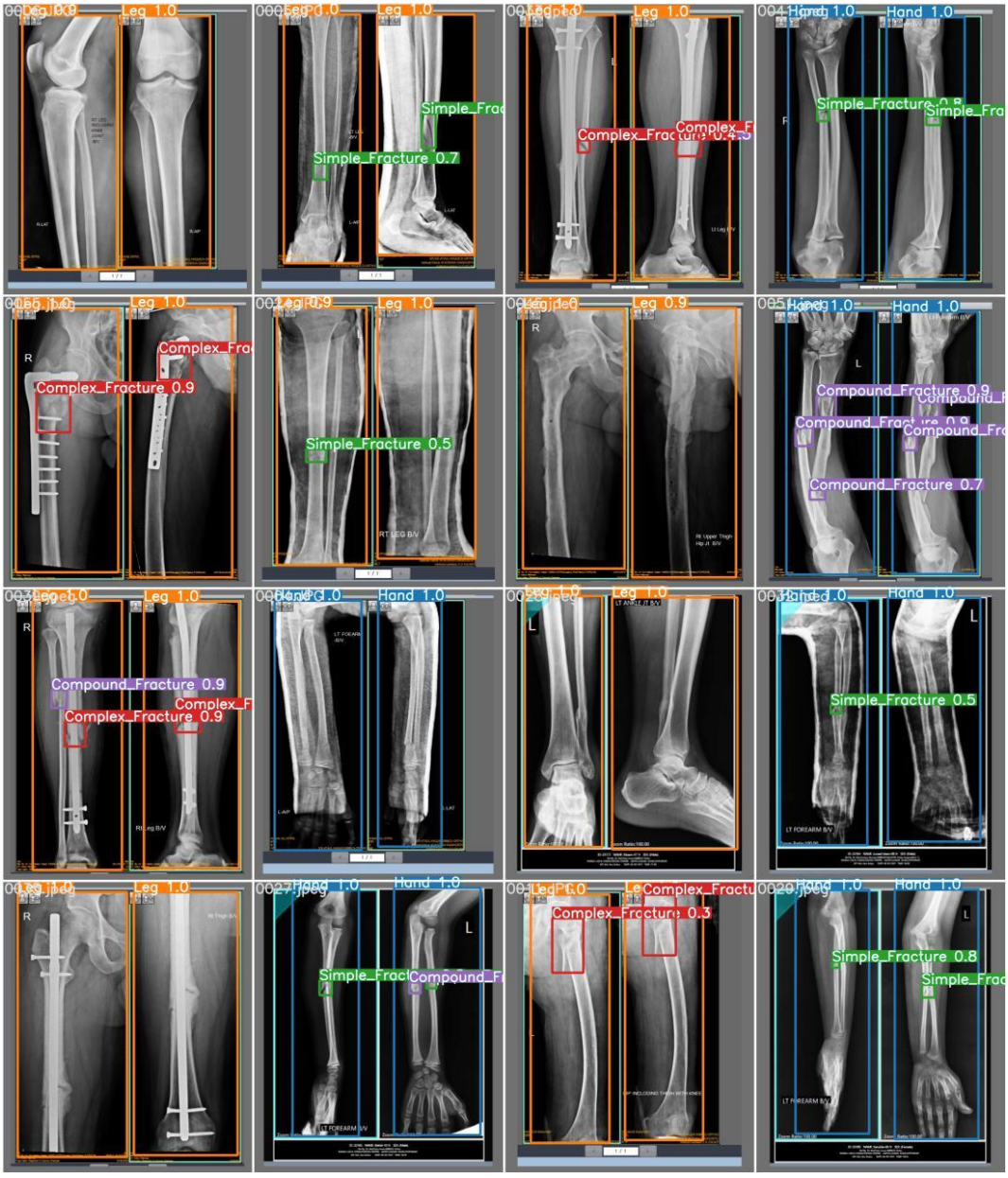


Figure 12:output of YOLO V7

this is the output image we can see in the image our model can predict correctly hand leg images .Its also can predict small simple fracture it predict compound fracture and complex fracture correctly .

CHAPTER 5

5.CONCLUSION AND LIMITATION

5.1 CONCLUSION

Bone fracture Is common issue in medical but all fracture treatment are not common. There are different types of fracture and for that fracture doctor have different type of treatment .For bone fracture patient spend a lot of money for the treatment, but some time doctor did not find or detect the heir line fracture or small fracture for that reason patient fill pain after the treatment and some time patient lost their body parts for wrong treatment. Many people come to Dhaka for better treatment because all available treatment equipment are in Dhaka city .In covid19 situation a system made for detecting covid19 from X-ray images .it help them to detect covid19 faster .from this idea we want to made a system that can detect human bone fracture easily and doctor get faster opinion and doctor can make faster treatment decision .it Can also help the new doctor who just start treatment his patient .I have tried to make a system of low cost for a country like Bangladesh. For the work I have collect data but data amount is poor because hospital did not want to give their patient data .For my data sets I applied YOLO V7 Models . I use that algorithm because that algorithm is new very few Work find who use YOLO V7.YOLO V7 is faster and give better accuracy from the other model. after implement YOLO V7 on our data set we got model mAP (Mean Average precision), model accuracy 63%.We run 200 epochs our model predict 77% accurately for all time .For our model we have use only 300 x-ray images and its predict hand and leg data 99% and 94% correctly. For low amount of data our model did not predict simple Complex and compound fracture perfectly. If the number of data increase then the model accuracy will be increase .

5.2 LIMITATIONS

In my paper I have use only one model and my work the output is not so satisfied.IT may be for the poor amount of bone fracture data sets. Main problem is for Data collection those data are medical data and that is confidential and no other hospital want to give their patient data.In future I will take a good amount of data sets and use other model and compare the mAP .

6 REFERENCES

1. Yee Liang Thian, MBBS, FRCR Yiting Li, BEng Pooja Jagmohan, MBBS, FRCR • David Sia, MBBS,FRCR Vincent Ern Yao Chan, MB, BCh, BAO Robby T. Tan, PhD (2018) Convolutional Neural Networks for Automated Fracture Detection and Localization on Wrist Radiographs . June 27, 2018 Artificial Intelligence

2 . WaseemAbbas, Syed M. Adnan, M. Arshad Javid,Fahad Majeed,TalhaAhsan,Haroonzeb Syed Saqlian Hassan.(2020) Lower Leg Bone Fracture Detection and Classification Using Faster RCNN for X-Rays 2020 IEEE 23rd International Multitopic Conference

3.Hui-ZhaoWu Li-FengYan Xiao-Qing Liu, Yi-ZhouYu, Zuo-JunGeng, Wen-Juan Wu, Chun-Qing Han, Yong-QinGuo & Bu-LangGao (2021) The Feature Ambiguity Mitigate Operator model helps improve bone fracture detection on X-ray radiograph

4. D.H. Kim,T. MacKinnon (14 November 2017)Artificial intelligence in fracture detection: transfer learning from deep convolutional neural networks . 14 November 2017 ARTICAL IN PRESS

5. Bin Guan, Jinkun Yao , Guoshan Zhang, Xinbo Wang (18 June 2019) . Thigh fracture detection using deep learning method based on new dilated convolutional feature pyramid network . 18 June 2019

6. Saranya A,Dr. K.Kottilingam (2021) A Survey on Bone Fracture Identification Techniques using Quantitative and Learning Based Algorithms .2021 International Conference on Artificial Intelligence and Smart Systems

7. Linyan Xue, Weina Yan , Ping Luo , Xiongfeng Zhang ,Tetiana Chaikovska , Kun Liu , Wenshan Gao , Kun Yang (2021) Detection and localization of hand fractures based on GA_Faster R-CNN . 19 February 2021Alexandria Engineering Journal

8.L.Jagjeevan Rao ,Madupu Ramkumar,Chiranjeevi Kothapalli,Pradeep Raj Savarapu,CMAK Zeelan Basha (2020) Advanced computerized Classification of X-ray Images using CNN . 2020 Third International Conference on Smart Systems and Inventive Technology

9. Feng Yanga, Guohui Weib, Hui Cao, Mengmeng Xingc, Shuxuan Liud and Jing Liu (2021) Computer-Assisted Bone Fractures Detection Based on Depth Feature . IOP Conference Series 2021

10. Payman Hussein Hussan, Syefy Mohammed Mangj Al-Razoky,Hasanain Mohammed Manji Al-Rzoky (2021). Design of a Fracture Detection System based on Deep Program in a Convolutional Neural Network

11. Fırat Hardalaç, Fatih Uysal, Ozan Peker, Murat Çiçeklidağ , Tolga Tolunay, Nil Tokgöz,Uğurhan Kutbay , Boran Demirciler and Fatih Mert (2022) . Fracture Detection in Wrist X-ray Images Using Deep Learning-Based Object Detection Models 2022

12. Josep de Cid Rodr´ıguez (2021) Fracture detection from X-Rays with Deep Learning.

13 .MAHMOUD AL-AYYOUB ,DUHA AL-ZGHOOL (2020). Determining the Type of Long Bone Fractures in X-Ray Images. WSEAS TRANSACTIONS on INFORMATION SCIENCE and APPLICATIONS .2020

14. Oishila Bandyopadhyaya, Arindam Biswasa, Bhargab B. Bhattacharya. (2015)Long-bone Fracture Detection in Digital X-ray Images Based on Digital-Geometric Techniques

15. CMAK Zeelan Basha, T. Maruthi Padmaja, G. N. Balaji (2019).

An Effective and Reliable Computer Automated Technique for Bone Fracture Detection. EAI Endorsed Transactions,2019

16.Tanushree Meena and Sudipta Roy (2022) Bone Fracture Detection Using Deep Supervised Learning from Radiological Images: A Paradigm Shift

17. YanglingMa , YixinLuo (2021) Bone fracture detection through the two-stage system of Crack-Sensitive Convolutional Neural Network. ScienceDirect 2021

18. Salih Beyaz, Koray Açıcı, and Emre Sümer 2020 Femoral neck fracture detection in X-ray images using deep learning and genetic algorithm approaches . National library of medicine 2020

19. Dhirendra Prasad Yadav ,Ashish Sharma ,Senthil Athithan (2022) Hybrid SFNet Model for Bone Fracture Detection and Classification Using ML/DL

20. N.Umadevi, Dr.S.N.GeethaJakshmi MUL TIPLE CLASSIFICATION SYSTEM FOR FRACTURE DETECTION IN HUMAN BONE X-RAY IMAGES

21. Hoai Phuong Nguyen; Thi Phuong Hoang; Huy Hoang Nguyen (15-16 October 2021) A deep learning based fracture detection in arm bone X-ray images.IEEE 2021

22. Yu Cao, Hongzhi Wang, Mehdi Moradi, Prasanth Prasanna,Tanveer F. Syeda-Mahmood (2015) FRACTURE DETECTION IN X-RAY IMAGES THROUGH STACKED RANDOM FORESTS FEATURE FUSION 2015 IBM Research

23. BinGuan,GuoshanZhang, JinkunYao,XinboWang,MengxuanWang (2020) Arm fracture detection in X-rays based on improved deep convolutional neural network.

24 Shuzhen Lu,Shengsheng Wang,Guangyao Wang (2022) Automated universal fractures detection in X-ray images based on deep learning approach 04 June 2022

25. Bin Guan,Jinkun Yao,Guoshan Zhang Xinbo Wang (2019) Thigh fracture detection using deep learning method based on new dilated convolutional feature pyramid network. 2019 Pattern Recognition Letters.

26. Bin Guan,Jinkun Yao ,Shaoquan Wang ,Guoshan Zhang,Yueming Zhang,Xinbo Wang,Mengxuan Wang(2022) Automatic detection and localization of thighbone fractures in X-ray based on improved deep learning method. February 2022

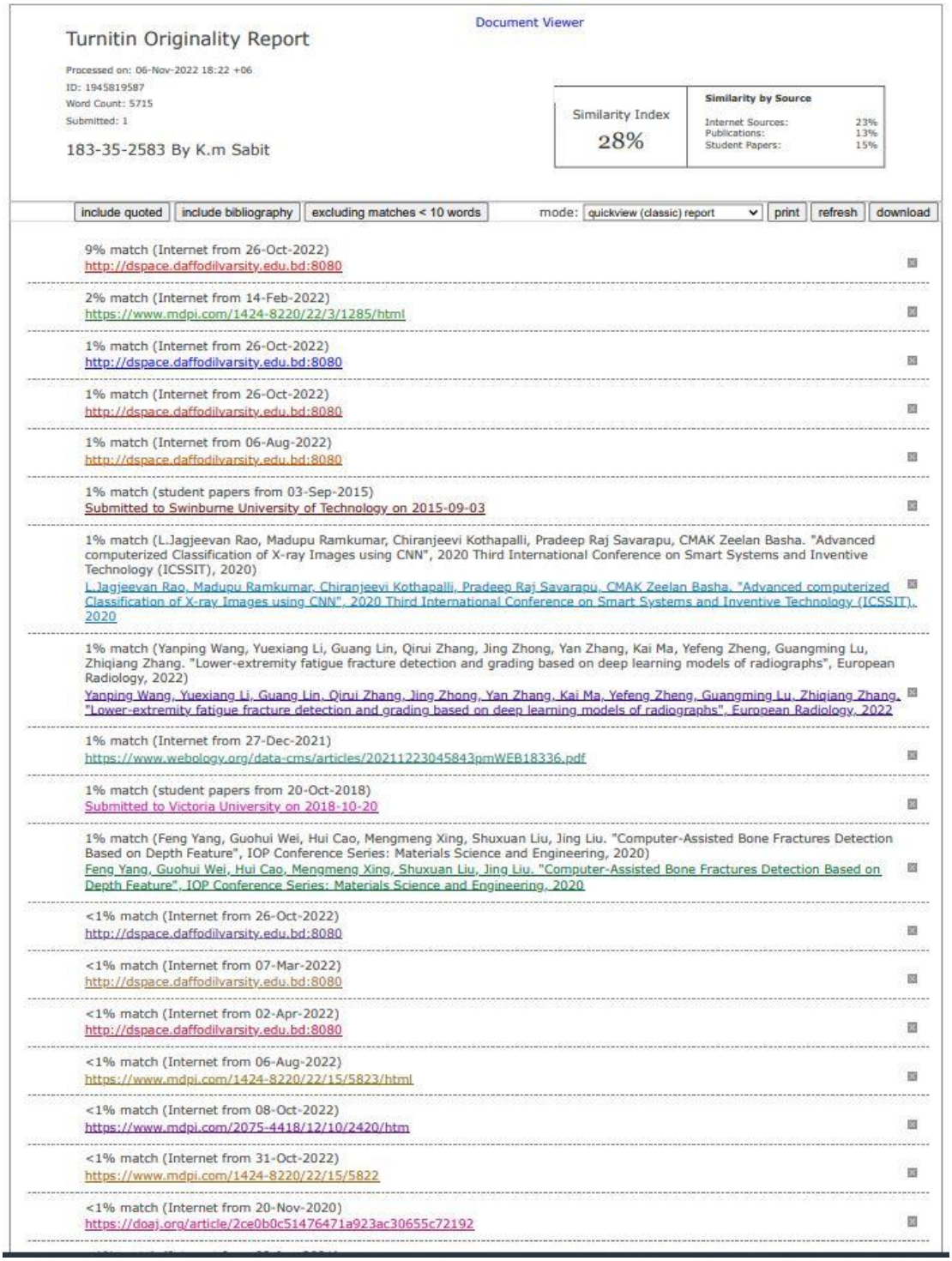
27. Changhwan Lee, Jongseong Jang, Seunghun Lee, Young Soo Kim, Hang Joon Jo & Yeesuk Kim 2020. Classification of femur fracture in pelvic X-ray images using meta-learned deep neural network. 13 August 2020.

28. Yang Jia,Haijuan Wang,Weiguang Chen,Yagang Wang,Bin Yang. An attention-based cascade R-CNN model for sternum fracture detection in X-ray images. 09 January 2022.

29. Shaghayegh Shahiri Tabarestani; Ali Aghagolzadeh; Mehdi Ezoji 2017 one Fracture Detection and Localization on MURA Database Using Faster-RCNN. 2021 7th International Conference on Signal Processing and Intelligent Systems (ICSPIS).

30.LinyanXue,WeinaYan,PingLuo,XiongfengZhang,TetianaChaikovska,KunLiu,WenshanGao,KunYang. October 2021. Detection and localization of hand fractures based on GA_Faster R-CNN. October 2021

PLAGARISM REPORT:



Document Viewer

Turnitin Originality Report

Processed on: 06-Nov-2022 18:22 +06
ID: 1945819587
Word Count: 5715
Submitted: 1

183-35-2583 By K.m Sabit

Similarity Index	Similarity by Source	
28%	Internet Sources:	23%
	Publications:	13%
	Student Papers:	15%

include quoted | include bibliography | excluding matches < 10 words | mode: quickview (classic) report | print | refresh | download

9% match (Internet from 26-Oct-2022)
http://dspace.daffodilvarsity.edu.bd:8080

2% match (Internet from 14-Feb-2022)
https://www.mdpi.com/1424-8220/22/3/1285/html

1% match (Internet from 26-Oct-2022)
http://dspace.daffodilvarsity.edu.bd:8080

1% match (Internet from 26-Oct-2022)
http://dspace.daffodilvarsity.edu.bd:8080

1% match (Internet from 06-Aug-2022)
http://dspace.daffodilvarsity.edu.bd:8080

1% match (student papers from 03-Sep-2015)
Submitted to Swinburne University of Technology on 2015-09-03

1% match (L.Jagjeevan Rao, Madupu Ramkumar, Chiranjeevi Kothapalli, Pradeep Raj Savarapu, CMAK Zeelan Basha. "Advanced computerized Classification of X-ray Images using CNN", 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020)
L.Jagjeevan Rao, Madupu Ramkumar, Chiranjeevi Kothapalli, Pradeep Raj Savarapu, CMAK Zeelan Basha. "Advanced computerized Classification of X-ray Images using CNN", 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020

1% match (Yanping Wang, Yuexiang Li, Guang Lin, Qirui Zhang, Jing Zhong, Yan Zhang, Kai Ma, Yefeng Zheng, Guangming Lu, Zhiqiang Zhang. "Lower-extremity fatigue fracture detection and grading based on deep learning models of radiographs", European Radiology, 2022)
Yanping Wang, Yuexiang Li, Guang Lin, Qirui Zhang, Jing Zhong, Yan Zhang, Kai Ma, Yefeng Zheng, Guangming Lu, Zhiqiang Zhang, "Lower-extremity fatigue fracture detection and grading based on deep learning models of radiographs", European Radiology, 2022

1% match (Internet from 27-Dec-2021)
https://www.webology.org/data-cms/articles/20211223045843pmWEB18336.pdf

1% match (student papers from 20-Oct-2018)
Submitted to Victoria University on 2018-10-20

1% match (Feng Yang, Guohui Wei, Hui Cao, Mengmeng Xing, Shuxuan Liu, Jing Liu. "Computer-Assisted Bone Fractures Detection Based on Depth Feature", IOP Conference Series: Materials Science and Engineering, 2020)
Feng Yang, Guohui Wei, Hui Cao, Mengmeng Xing, Shuxuan Liu, Jing Liu. "Computer-Assisted Bone Fractures Detection Based on Depth Feature", IOP Conference Series: Materials Science and Engineering, 2020

<1% match (Internet from 26-Oct-2022)
http://dspace.daffodilvarsity.edu.bd:8080

<1% match (Internet from 07-Mar-2022)
http://dspace.daffodilvarsity.edu.bd:8080

<1% match (Internet from 02-Apr-2022)
http://dspace.daffodilvarsity.edu.bd:8080

<1% match (Internet from 06-Aug-2022)
https://www.mdpi.com/1424-8220/22/15/5823/html

<1% match (Internet from 08-Oct-2022)
https://www.mdpi.com/2075-4418/12/10/2420/htm

<1% match (Internet from 31-Oct-2022)
https://www.mdpi.com/1424-8220/22/15/5822

<1% match (Internet from 20-Nov-2020)
https://doaj.org/article/2ce0b0c51476471a923ac30655c72192

ACCOUNTS CLEARANCE: