

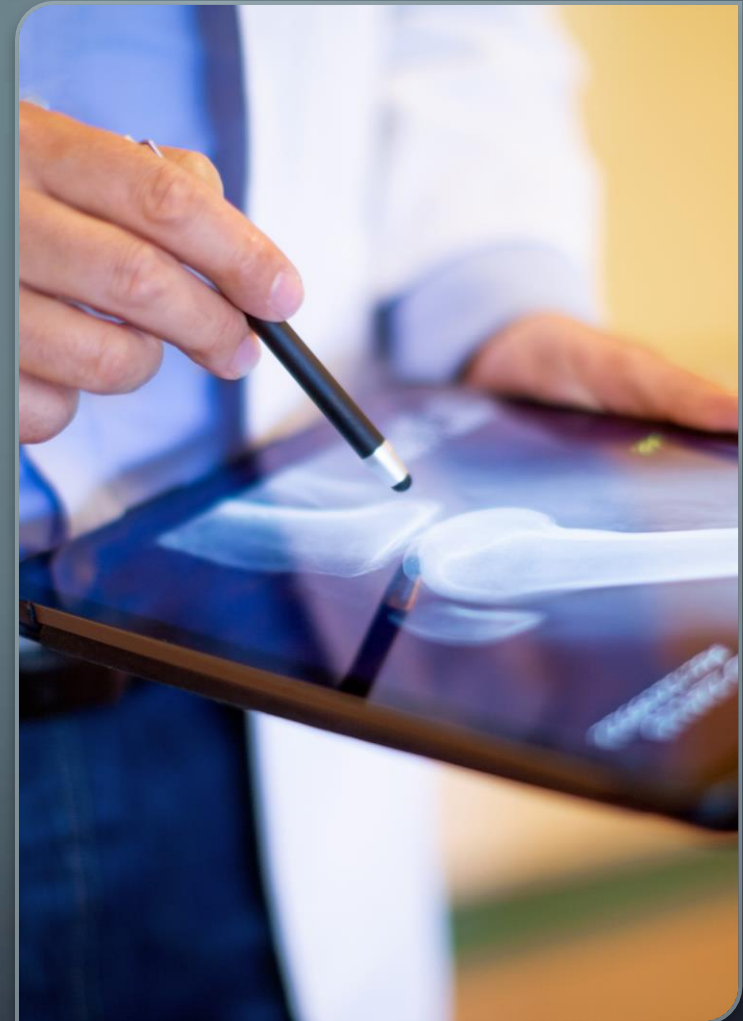
A decorative graphic on the left side of the slide, consisting of a network of white lines and small circles on a dark blue background, resembling a circuit board or a neural network diagram.

# PREDICTING GOUT IN ER PATIENTS

ICLASSIFY PATIENTS 'CHIEF COMPLAINT' AS 'GOUT' OR 'NOT GOUT'

## WHY? should we build a model that predicts the diagnosis of gout?

- 10 out of 100 patients were mislabeled by ER physicians
- Studies show 1 cause of misdiagnosis is due to vocabulary usage differences.
- Vocabulary patterns can be recognized by ML models and aid in predicting 'Gout' based on the patient's complaint bridging the very gap that causes these errors.



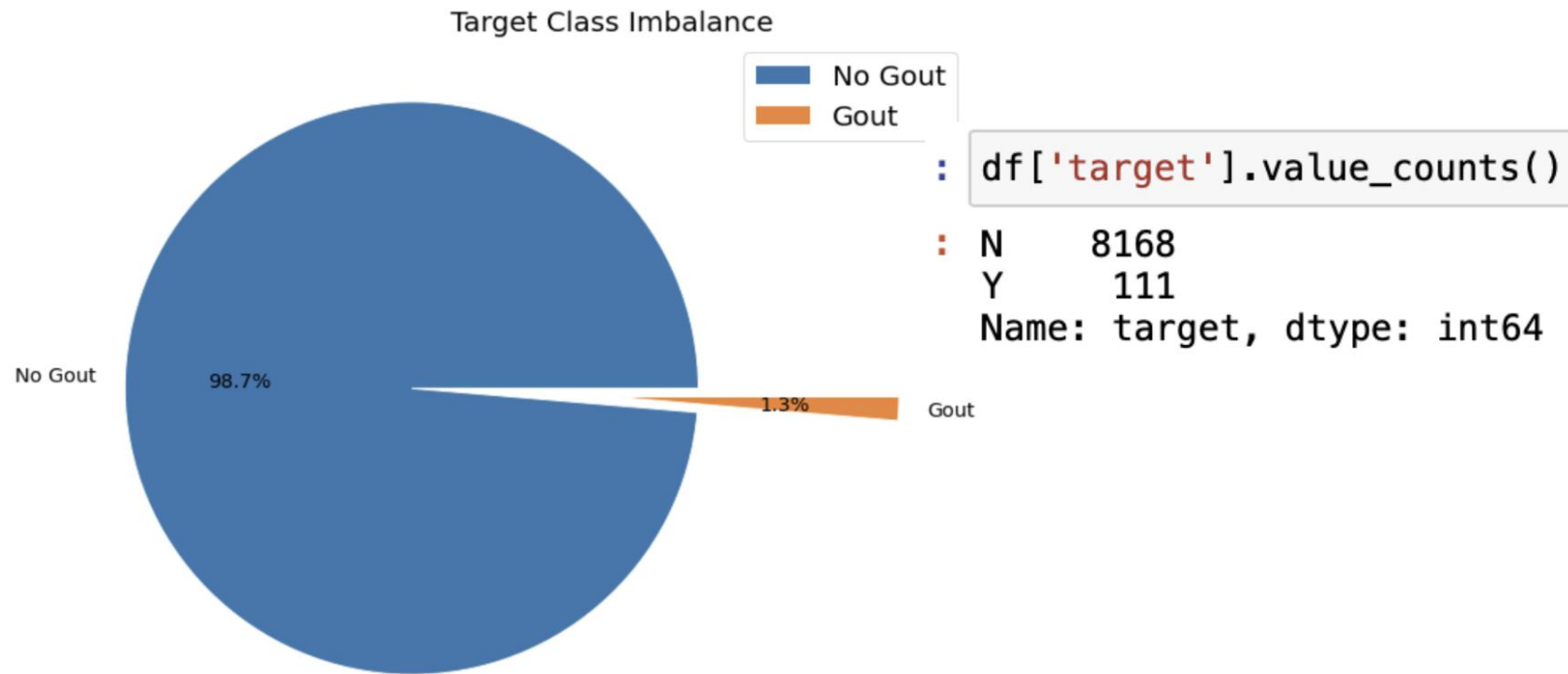


## DATA SOURCE

- Kaggle: [Knee Osteoarthritis Dataset with Severity Grading](#)
- [Mendeley Data](#) (Chen, Pingjun (2018), “Knee Osteoarthritis Severity Grading Dataset”, Mendeley Data, V1, doi: 10.17632/56rmx5bjcr.1)

# IMBALANCED DATA

Class Distribution is significantly imbalanced.





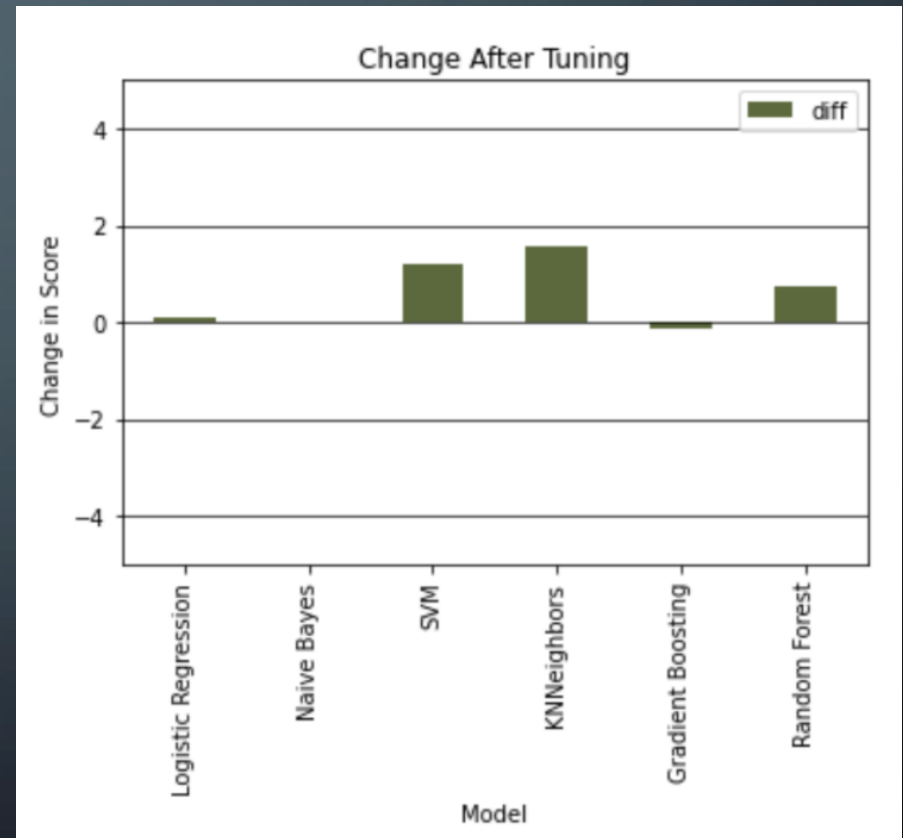
# MODELING

- CLASSIFICATION MODELS USING SCI-KIT LEARN
  - \* Logistic Regression
  - \* Naive Bayes
  - \* Support Vector Machine
  - \* KNneighbors
  - \* Gradient Boost
  - \* Random Forest
- BERT PRE-Trained Models



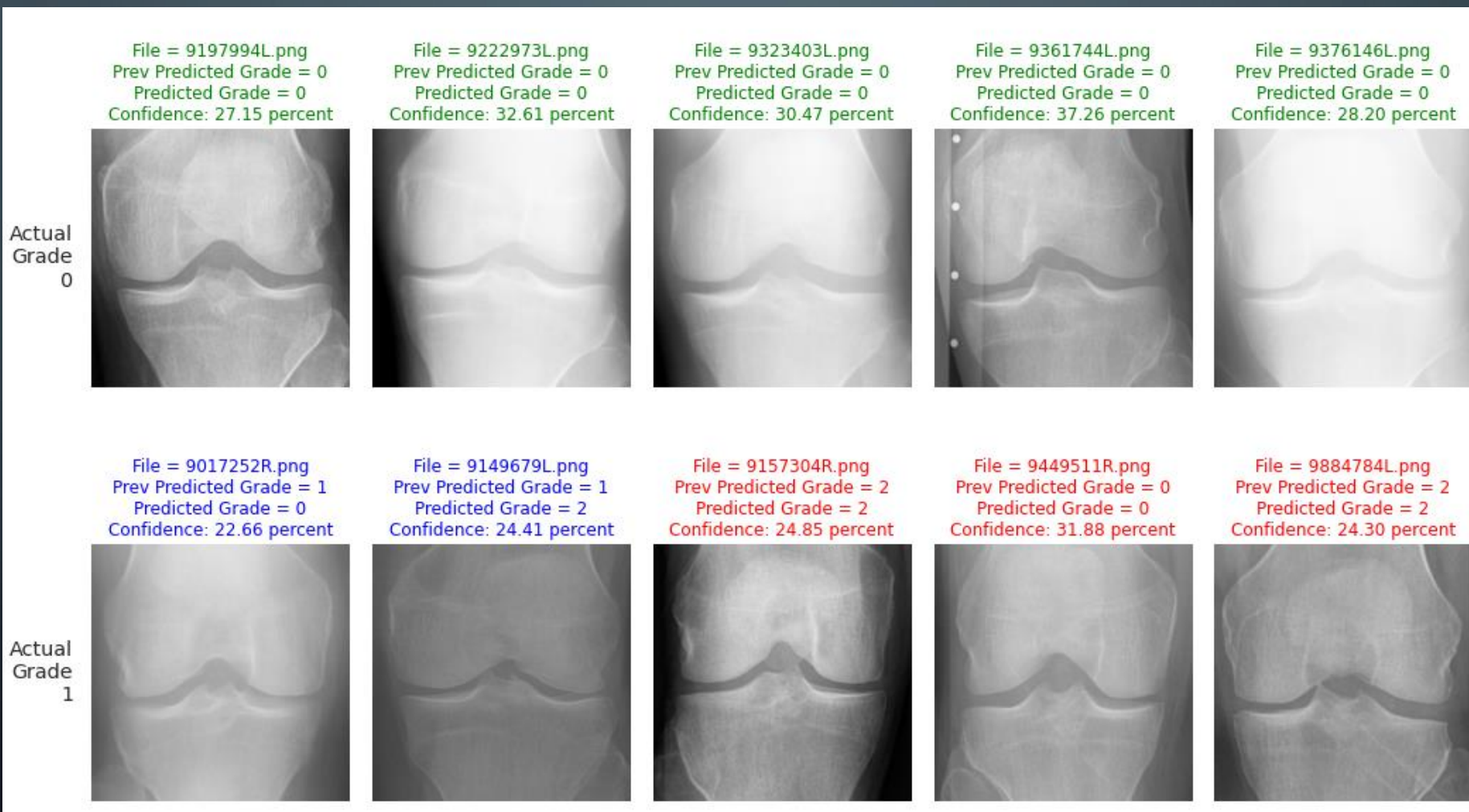
# ROC AUC SCORES before and after hyperparameter tuning

model	tuned score	untuned score
Logistic Regression	93.897341	93.794682
Naive Bayes	92.226345	92.226345
SVM	93.209647	91.996289
KNNighbors	86.552257	84.988868
Gradient Boosting	91.137910	91.289425
Random Forest	91.288806	90.529375



# SAMPLE KNEE IMAGES FROM TEST SET (GRADE 0-1)

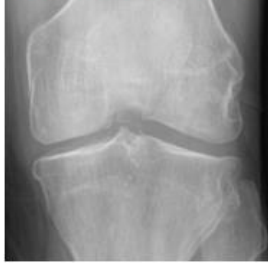
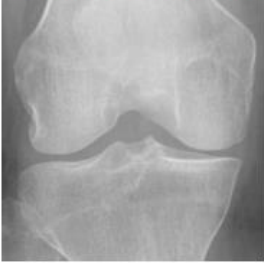
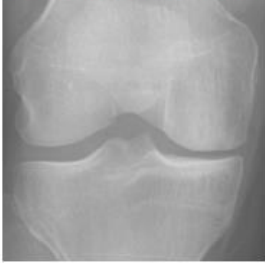

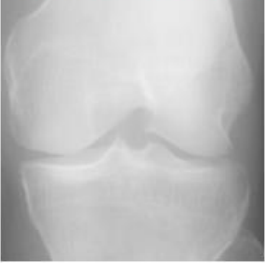
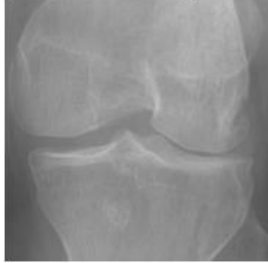
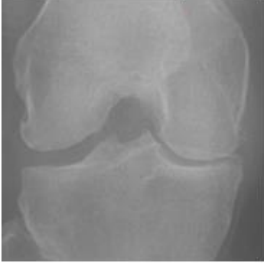

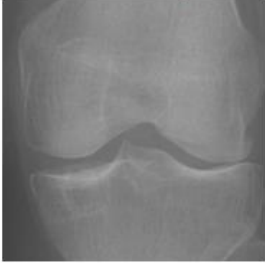
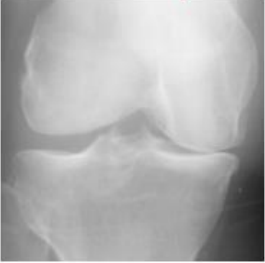





PREDICTION ACCURACY = 44%





# SAMPLE KNEE IMAGES FROM TEST SET (GRADE 2-4)

PREDICTION ACCURACY = 44%

Actual Grade 2	<p>File = 9183590L.png Prev Predicted Grade = 3 Predicted Grade = 3 Confidence: 26.48 percent</p> 	<p>File = 9224061R.png Prev Predicted Grade = 0 Predicted Grade = 0 Confidence: 24.86 percent</p> 	<p>File = 9634146R.png Prev Predicted Grade = 0 Predicted Grade = 0 Confidence: 25.18 percent</p> 	<p>File = 9837371R.png Prev Predicted Grade = 0 Predicted Grade = 1 Confidence: 24.15 percent</p> 	<p>File = 9930588L.png Prev Predicted Grade = 3 Predicted Grade = 3 Confidence: 30.89 percent</p> 
	<p>File = 9556464L.png Prev Predicted Grade = 2 Predicted Grade = 3 Confidence: 23.80 percent</p> 	<p>File = 9660697R.png Prev Predicted Grade = 4 Predicted Grade = 3 Confidence: 34.25 percent</p> 	<p>File = 9664468L.png Prev Predicted Grade = 3 Predicted Grade = 3 Confidence: 34.66 percent</p> 	<p>File = 9809967L.png Prev Predicted Grade = 1 Predicted Grade = 1 Confidence: 23.36 percent</p> 	<p>File = 9870569R.png Prev Predicted Grade = 4 Predicted Grade = 4 Confidence: 27.70 percent</p> 
	<p>File = 9012867R.png Prev Predicted Grade = 4 Predicted Grade = 4 Confidence: 33.90 percent</p> 	<p>File = 9194300L.png Prev Predicted Grade = 3 Predicted Grade = 3 Confidence: 35.42 percent</p> 	<p>File = 9390064R.png Prev Predicted Grade = 4 Predicted Grade = 3 Confidence: 28.90 percent</p> 	<p>File = 9559547R.png Prev Predicted Grade = 4 Predicted Grade = 4 Confidence: 34.57 percent</p> 	<p>File = 9841033R.png Prev Predicted Grade = 4 Predicted Grade = 4 Confidence: 33.42 percent</p> 
	Actual Grade 4				



# SIMPLIFYING INTO 3 CLASSES

- **A** : Grades **0 (None)** and **1 (Doubtful)** : a reasonably healthy knee, patient with knee pain may wish to explore other causes
- **B** : Grade **2 (Minimal)** : patient has minimal OA and should consider lifestyle changes, and possibly medication
- **C** : Grades **3 (Moderate)** and **4 (Severe)** : knee replacement and other procedures and/or surgeries may be an option

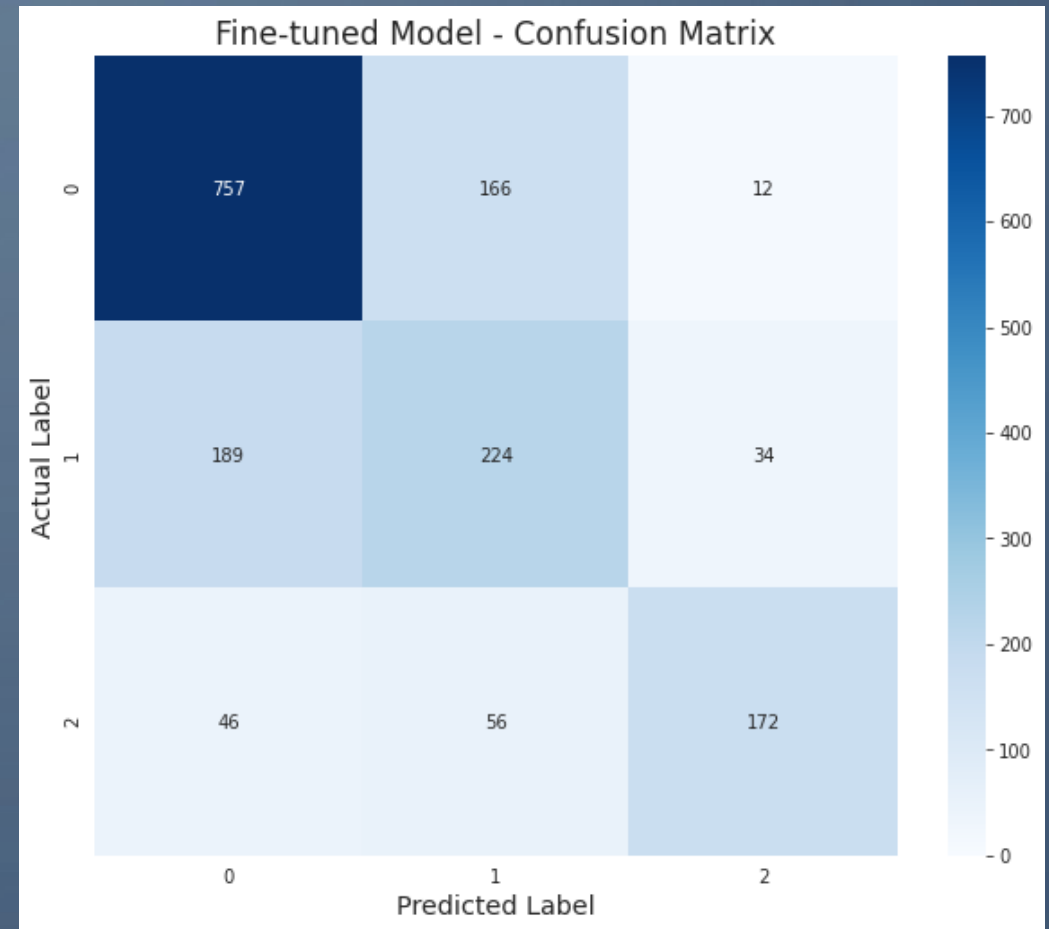
# MODELING – SIMPLIFIED 3 CLASSES

ACCURACY = 70%

```
Fine-tuned model - Classification Report:
              precision    recall  f1-score   support

     0         0.76        0.81        0.79        935
     1         0.50        0.50        0.50        447
     2         0.79        0.63        0.70        274

 accuracy         0.70        1656
 macro avg        0.68        0.65        0.66        1656
 weighted avg     0.70        0.70        0.69        1656
```



# SAMPLE KNEE IMAGES FROM TEST SET (CLASS A)

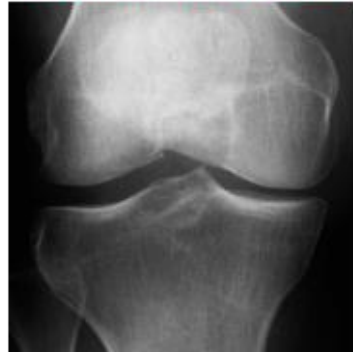
PREDICTION ACCURACY = 73.33 %

Actual  
Label  
A

File = 9024409R.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 53.43 percent



File = 9055038R.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 38.96 percent



File = 9062161R.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 40.71 percent



File = 9115033R.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 40.99 percent



File = 9343691L.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 49.40 percent



Actual  
Label  
A

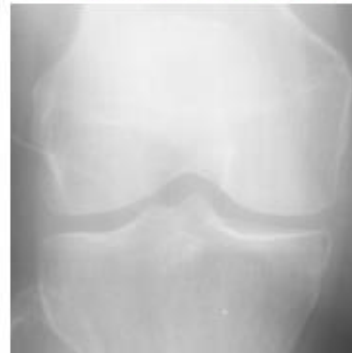
File = 9435145R.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 50.98 percent



File = 9449511R.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 54.35 percent



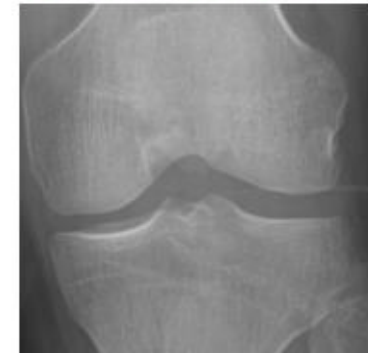
File = 9545822R.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 43.07 percent



File = 9546329R.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 53.92 percent



File = 9909758L.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 56.55 percent



# SAMPLE KNEE IMAGES FROM TEST SET (CLASS B)

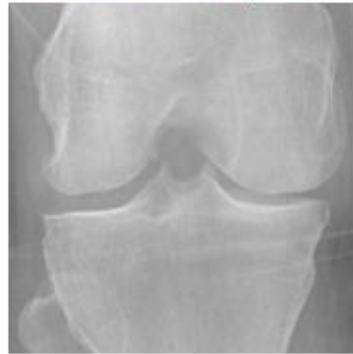
PREDICTION ACCURACY = 73.33 %

Actual  
Label  
B

File = 9006407R.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 39.05 percent



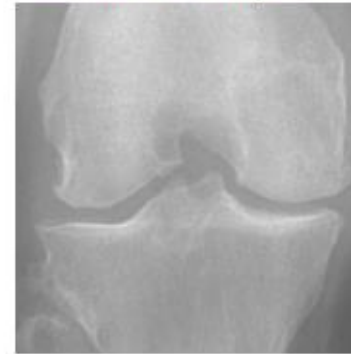
File = 9088866R.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 49.51 percent



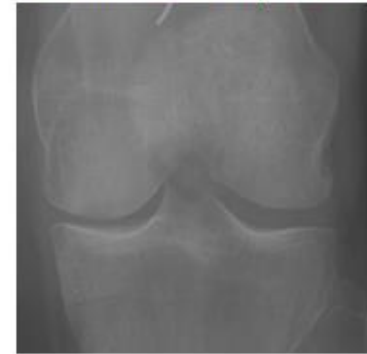
File = 9169499R.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 45.67 percent



File = 9222916R.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 46.67 percent

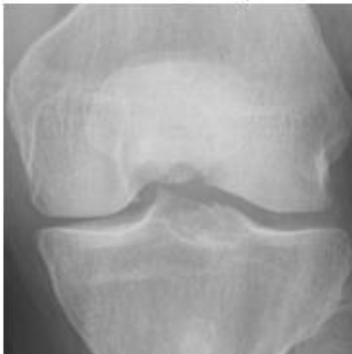


File = 9402978L.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 49.07 percent

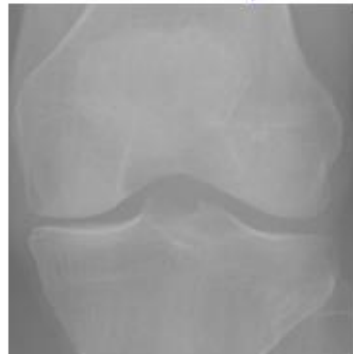


Actual  
Label  
B

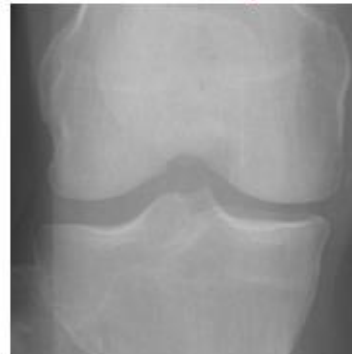
File = 9496443L.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 40.40 percent



File = 9534110L.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 37.52 percent



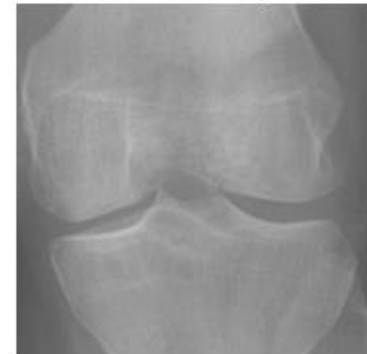
File = 9576694R.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 49.26 percent



File = 9607698R.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 39.85 percent



File = 9627152L.png  
Prev Predicted Label = B  
Predicted Label = B  
Confidence: 47.87 percent





# SAMPLE KNEE IMAGES FROM TEST SET (CLASS C)

PREDICTION ACCURACY = 73.33 %

Actual  
Label  
C

File = 9012867L.png  
Prev Predicted Label = C  
Predicted Label = C  
Confidence: 54.58 percent



File = 9055836L.png  
Prev Predicted Label = B  
Predicted Label = C  
Confidence: 51.13 percent



File = 9087632L.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 42.02 percent



File = 9267247L.png  
Prev Predicted Label = B  
Predicted Label = A  
Confidence: 39.57 percent

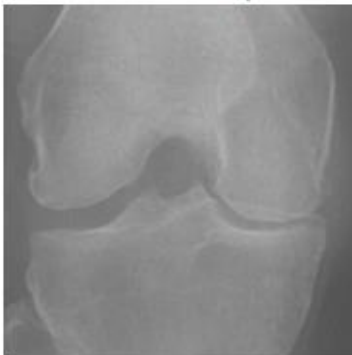


File = 9484333L.png  
Prev Predicted Label = C  
Predicted Label = C  
Confidence: 57.34 percent

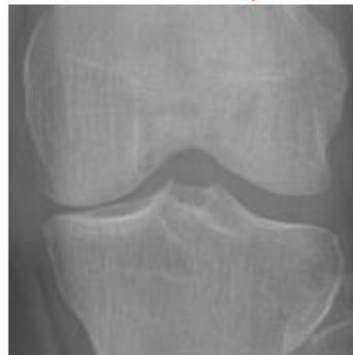


Actual  
Label  
C

File = 9660697R.png  
Prev Predicted Label = B  
Predicted Label = C  
Confidence: 49.37 percent



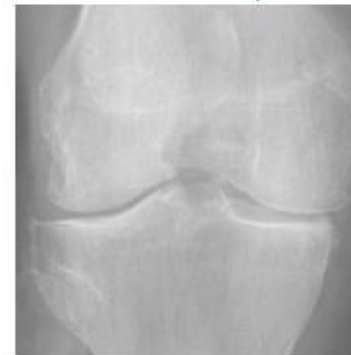
File = 9719748L.png  
Prev Predicted Label = A  
Predicted Label = A  
Confidence: 53.83 percent



File = 9856831L.png  
Prev Predicted Label = C  
Predicted Label = C  
Confidence: 57.30 percent



File = 9872810R.png  
Prev Predicted Label = C  
Predicted Label = C  
Confidence: 55.46 percent



File = 9964731R.png  
Prev Predicted Label = C  
Predicted Label = C  
Confidence: 53.90 percent



# FURTHER RESEARCH

1

Explore other  
methods of  
identifying knee  
OA from X-rays

2

Improve model  
– add more  
labeled images  
to training set

3

Additional fine-  
tuning, targeting  
grade 2 / class  
B classification