

# Joint Sounds as a Biomarker of Knee Injury Status

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# BACKGROUND

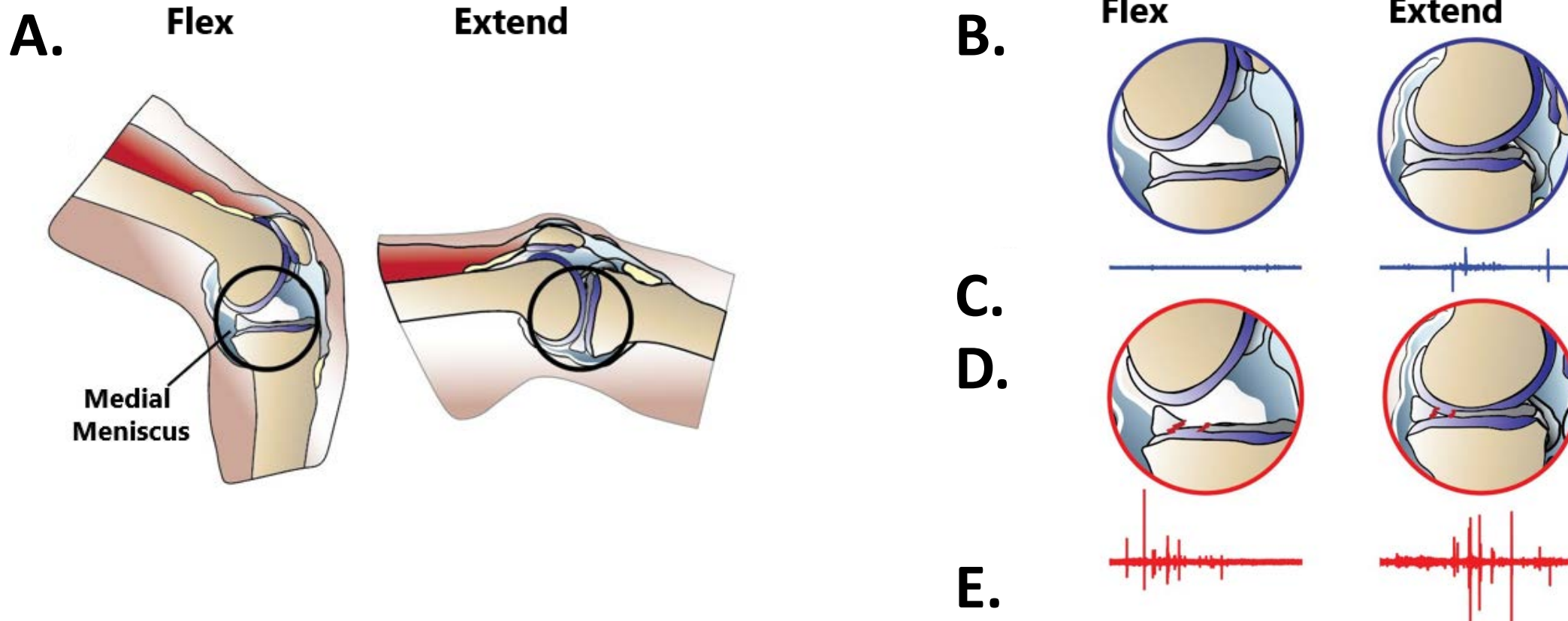
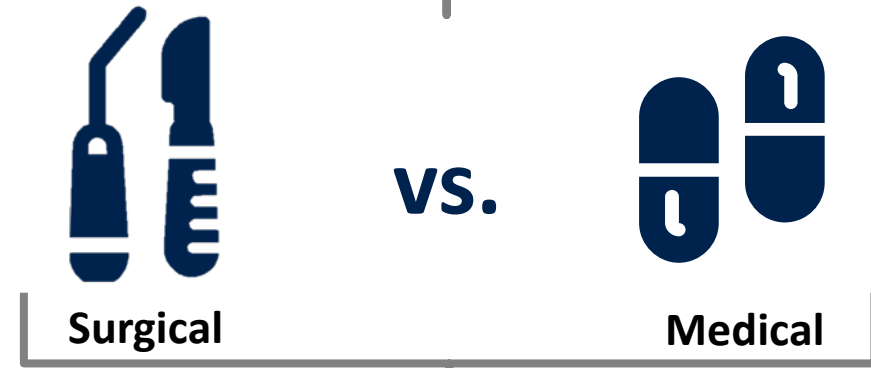
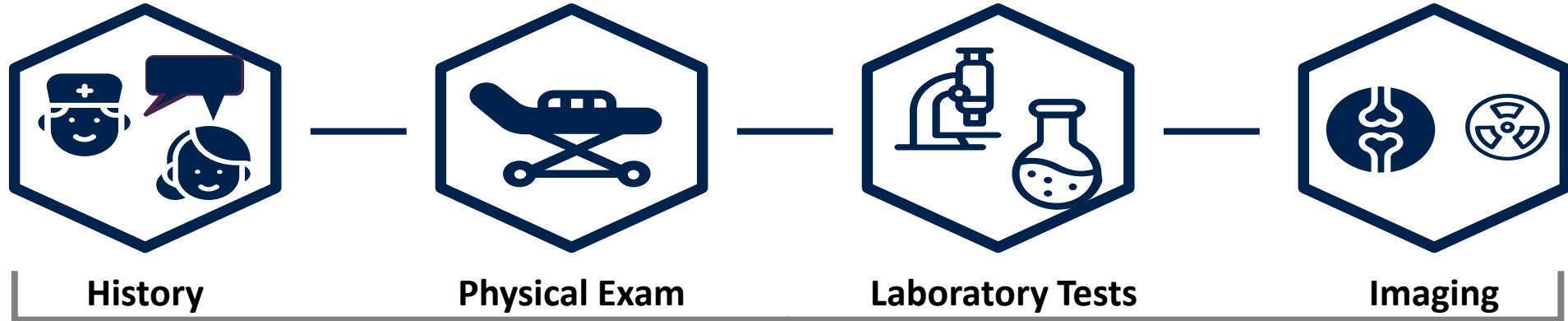
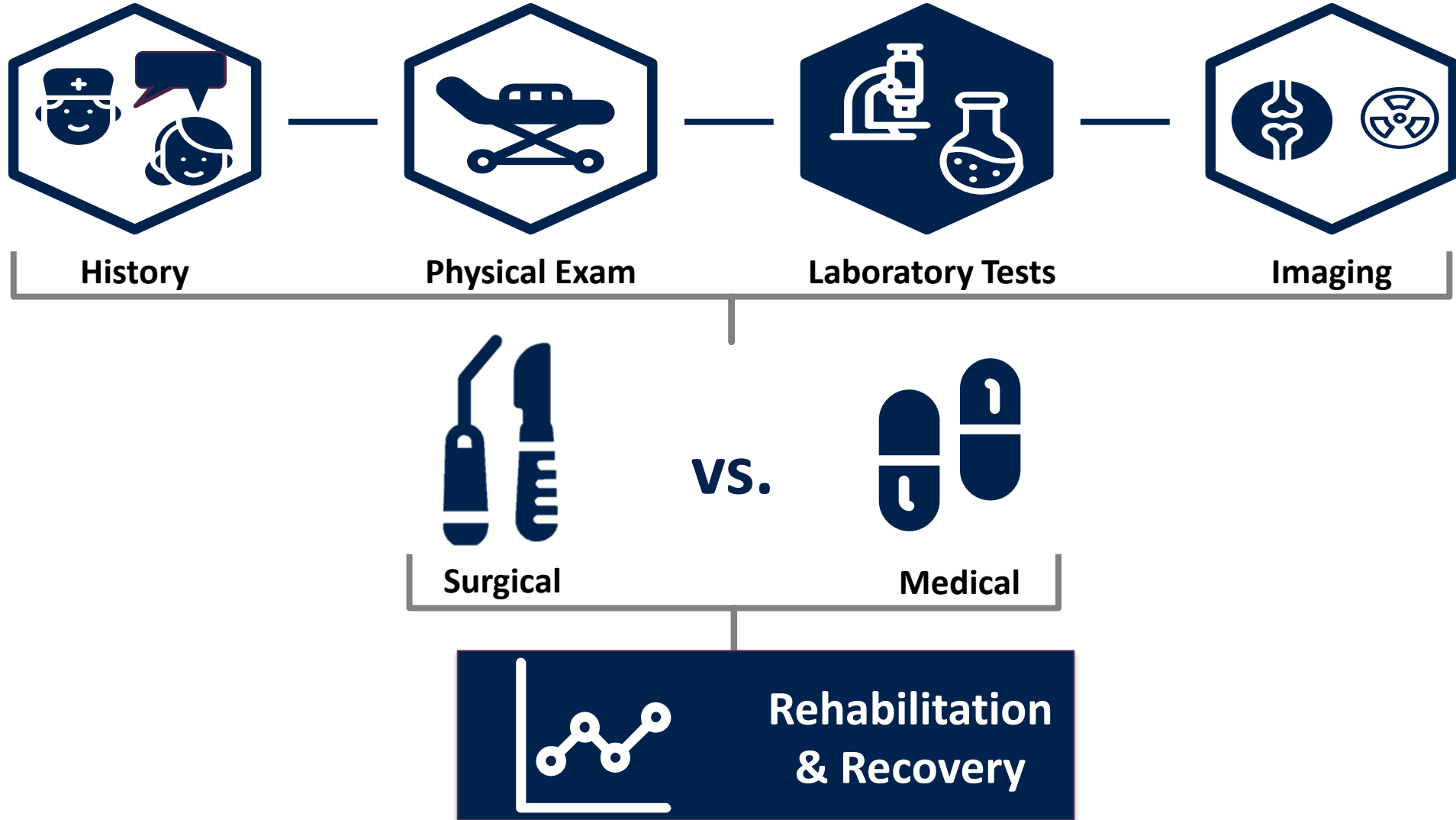


Fig 1. Proposed model of knee AE generation

# BACKGROUND



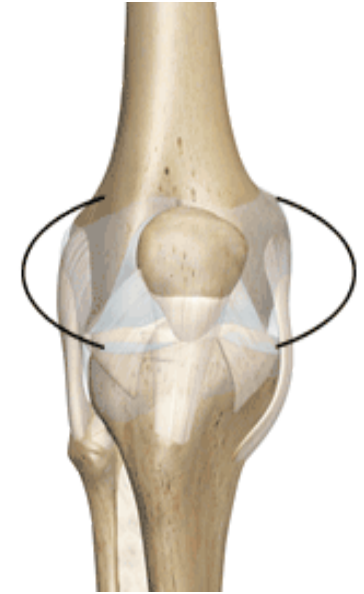
# BACKGROUND



# OBJECTIVE

Acoustic emissions (AEs) generated during joint articulation contain clinically-relevant information pertaining to the underlying health of joints.

**Can these sounds differentiate healthy knees from knees with acute meniscal tears?**



**Joint sounds**

# METHODOLOGY

Cadaver Model:

Clinical Data:

## Testing Stages:

- Baseline
- Sham
- Tear
- Removal

N=20

- Recruitment ongoing
- 11 meniscus tears
- Contralateral leg as control



Figure 2. Recording Setup

# METHODOLOGY

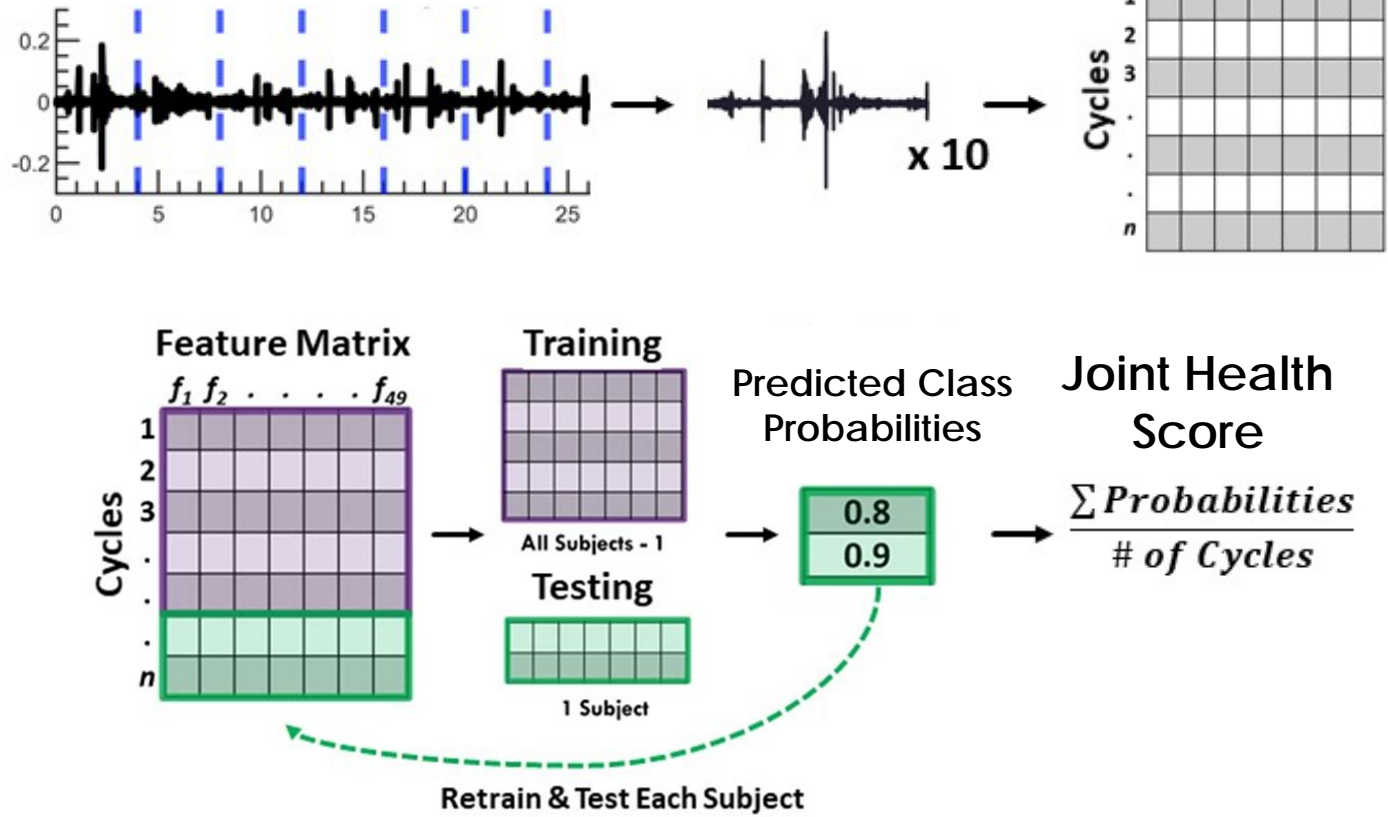


Fig 3. Leave-One-Subject-Out Cross Validation (LOSO-CV) is used to train the model

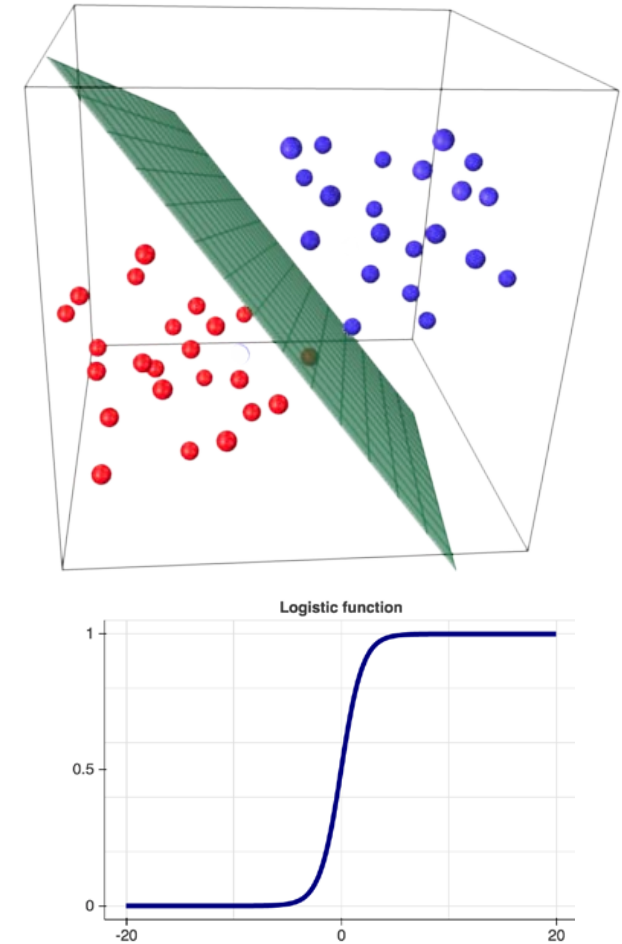
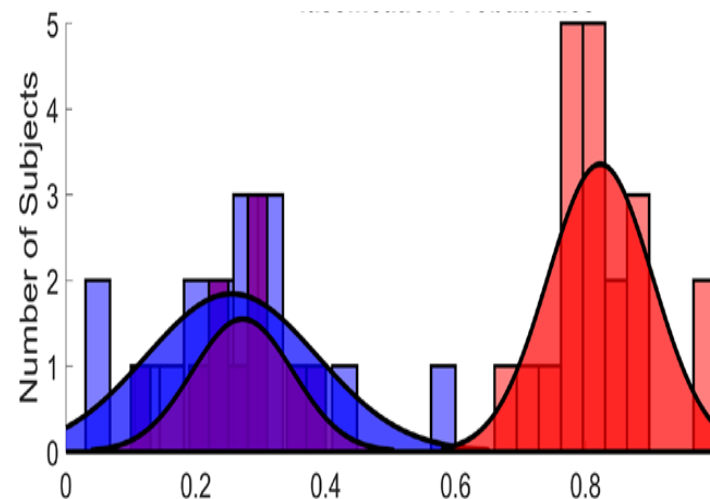
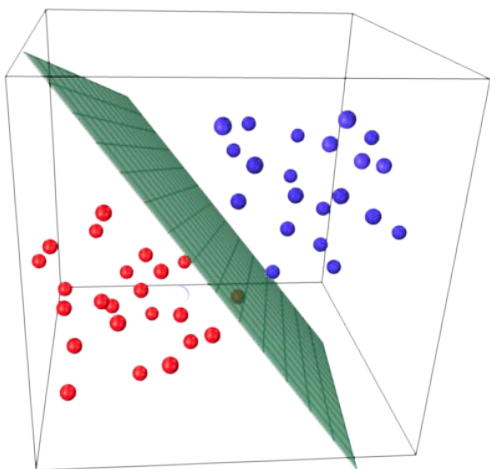


Fig 4. Logistic Function and classification hyperplane

# METHODOLOGY



**Model Trained using  
Cadaver Data**

**Model Outputs Joint Health  
Score for each patient**



# CADAVER RESULTS

Study Group:	Accuracy	Precision (PPV)	Recall (Sensitivity)	AUC
Lateral Tear – Cadaver	80%	75%	90%	91.5%
Medial Tear – Cadaver	90%	83%	100%	97.5%

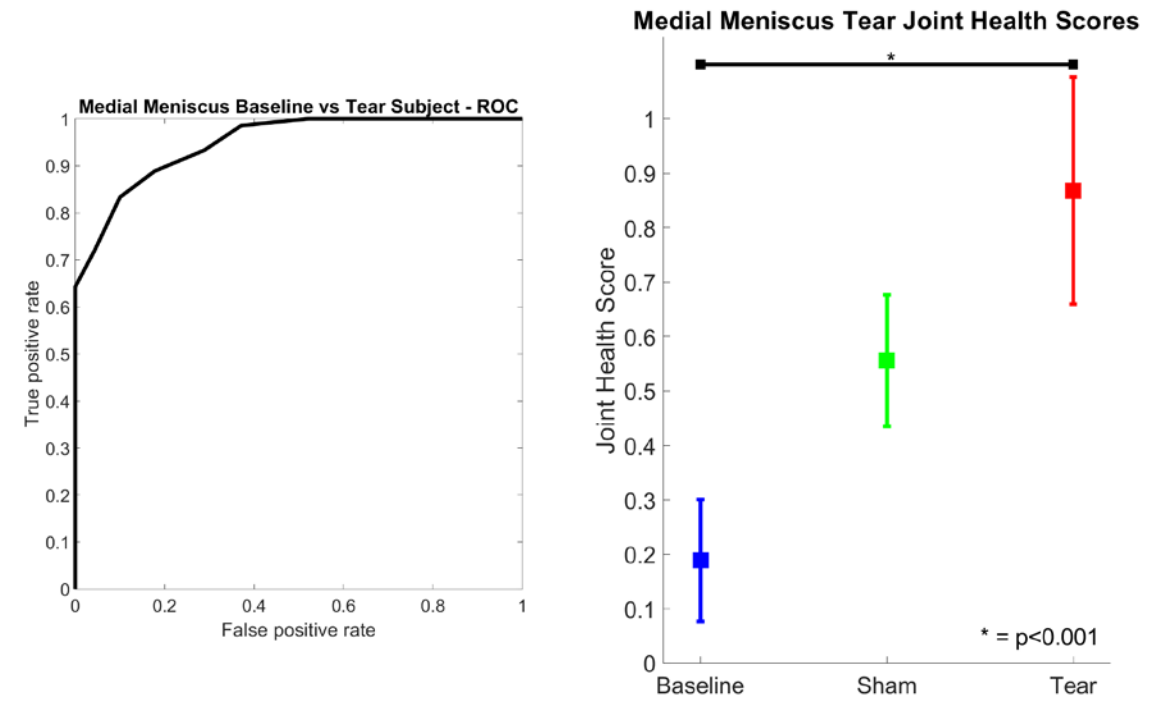
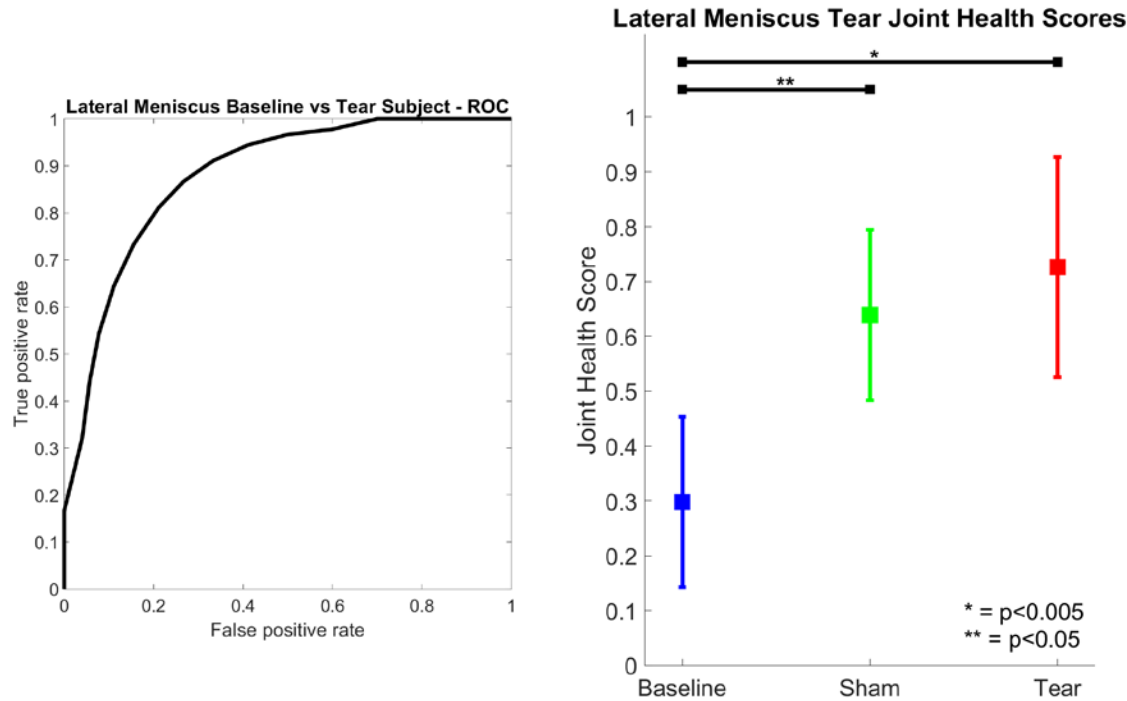


Fig 5. Cadaver Lateral Meniscus Tear Comparisons

Fig 6. Cadaver Medial Meniscus Tear Comparisons

# CLINICAL RESULTS

Study Group:	Accuracy	Precision (PPV)	Recall (Sensitivity)	AUC
Healthy Leg vs Meniscus Tear Leg	77%	69%	100%	100%

Healthy vs Meniscus Tear Subject Health Score

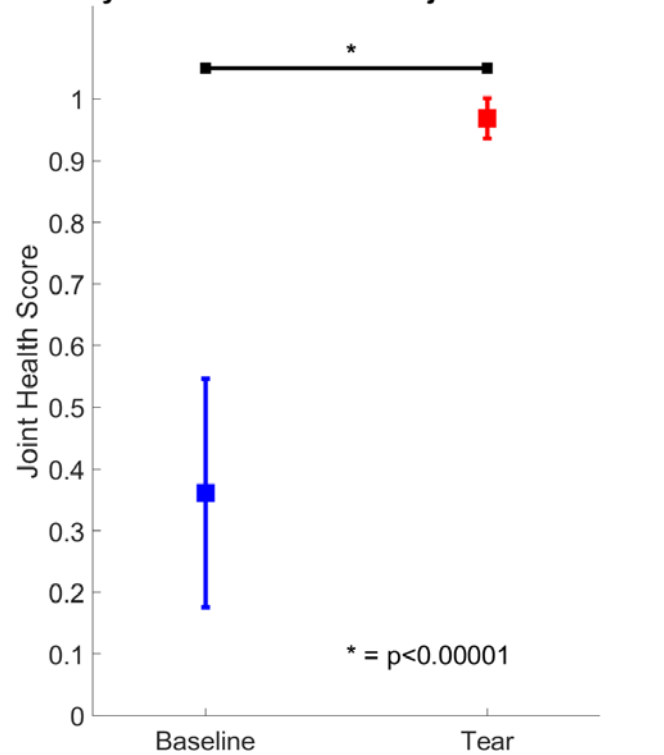


Fig 7. Human Subjects Meniscus Tear Comparisons

Classification Accuracy on Each Leg

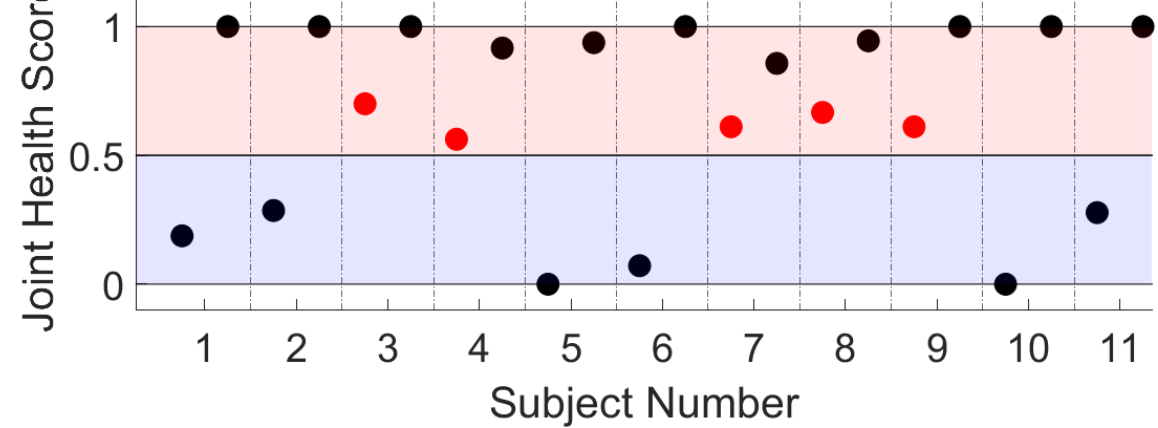


Fig 8. Leg Injury Classification Accuracy

N=11

# CONCLUSION

- Cycle based-AE analysis can accurately classify injury status in a cadaver model
- These patterns appear to be preserved *in vivo*.
- With further research, the proposed joint health score could be used as a biomarker of joint health.

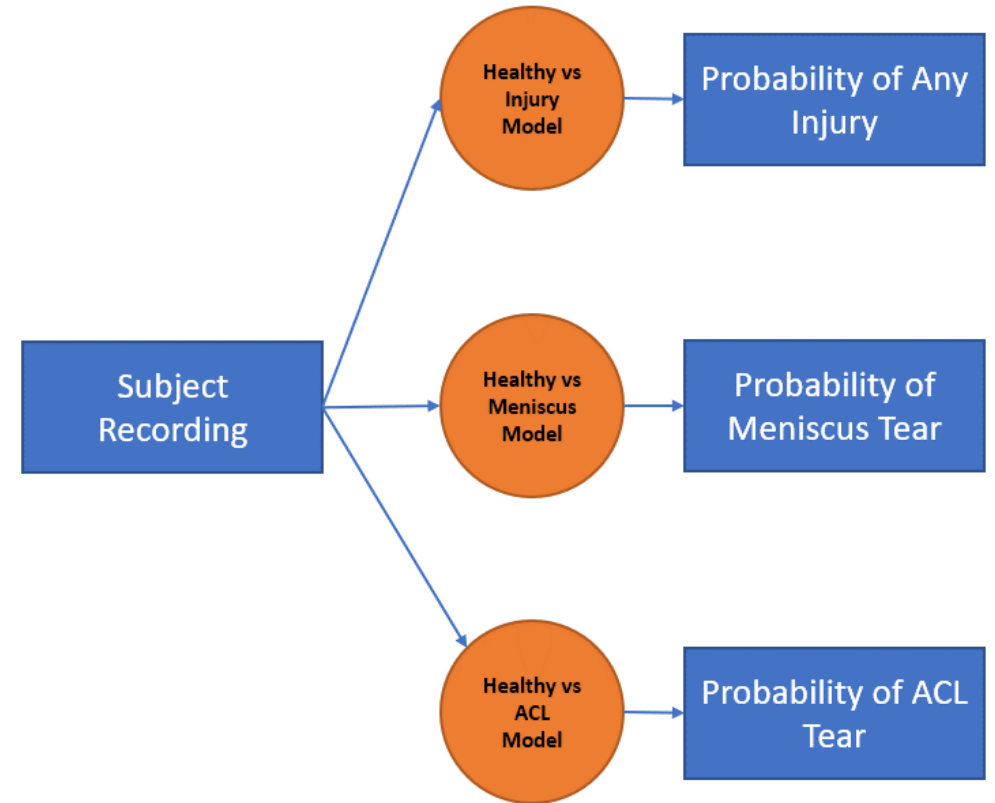


Figure 8. Acute Injury Classification Models Diagram

# THANK YOU!

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