Artificial Intelligence and Radiology

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ELHT

Why Artificial Intelligence (AI) ?

- Vastly Improve quality of care
- Timely diagnosis
- Aid stretched radiology workforce
- Automation of repetitive measurements
- Quantification of biomarkers
- Autonomous triaging of emergent findings


9:41 AM
What can I help you with?
What can I help you do now?

Challenges…

- Vast imaging data sets in PACS
- Access is difficult due to confidentiality
- Access can enable data analysis and training of algorithm to recognise the wide variation in imaging of various conditions
- Issues like Google-Deep mind

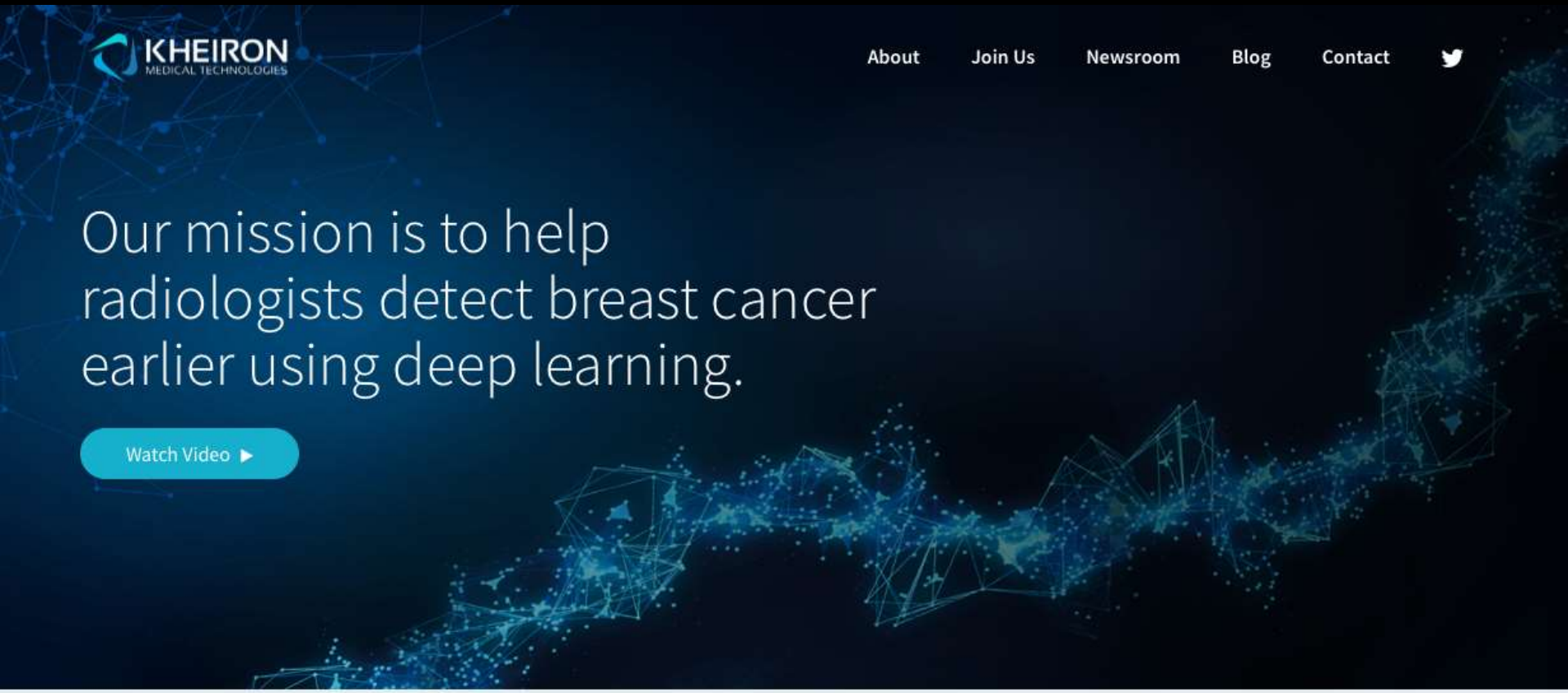
Google DeepMind 1.6m patient record deal 'inappropriate'

National data guardian says patient data transfer from Royal Free to Google subsidiary has 'inappropriate legal basis' as information not used for direct care

▲ The national data guardian said the transfer of patient data from the Royal Free was unsound as it was first used to test a new app, Streams. Photograph: Alamy

The transfer of 1.6m patient records to Google's artificial intelligence company DeepMind Health has been criticised for its "inappropriate legal basis" by the UK's national data guardian.

Success….



AS SEEN IN

Forbes THE WALL STREET JOURNAL. THE TIMES THE SUNDAY TIMES The Economist BBC

babylon

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Ask Babylon

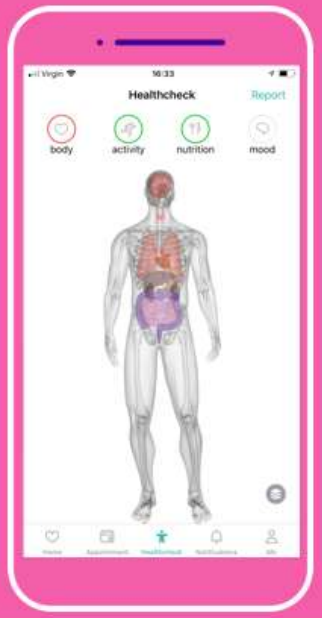
Hi Alex, how can I help?

I've got a really bad headache and I don't know what to do...

No problem, let me ask you a few questions

Talk to a doctor

Healthcheck



ASPIRE™ Service

CQC-regulated clinical service to
identify vertebral fractures

13 Oct, 2017

Machine Learning Technology

Vertebral Fracture Patients Known to the FLS

Hospital Site	Number of VF Found	Number of VF Patients Known to the FLS
Oxford	53	8
Croydon	26	3
Salford	75	-
Blackburn	47	4
Nottingham	15	13
Cambridge	42	-
TOTAL	258	28

- But very few make it to the FLS

Application of AI locally?

- Bony metastasis detection
- Articular cartilage assessment
- Rotator cuff tear detection

Application of AI locally?

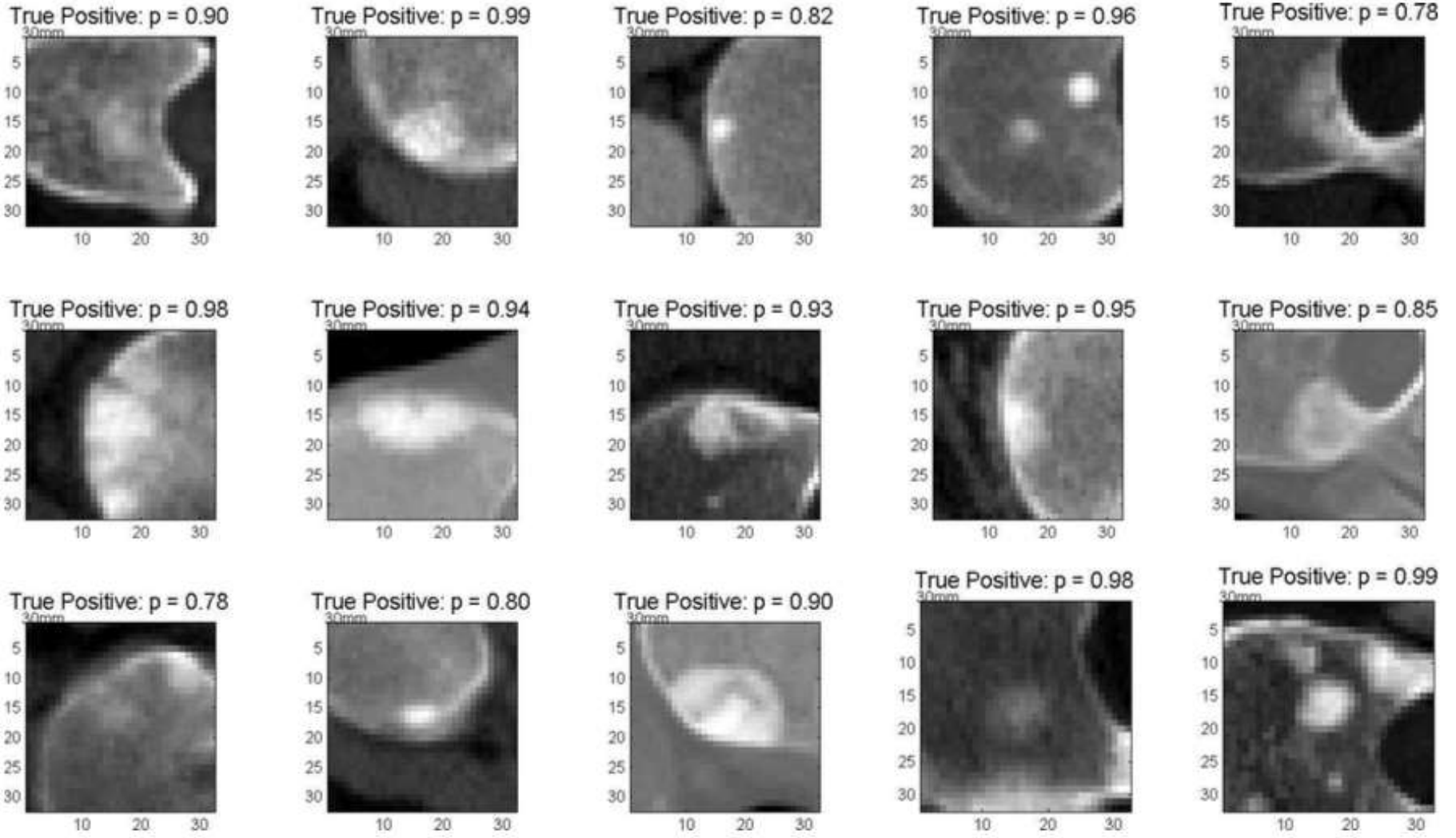
- **Bony metastasis detection**
- Articular cartilage assessment
- Rotator cuff tear detection

Detection of Sclerotic Spine Metastases via Random Aggregation of Deep Convolutional Neural Network Classifications

Holger R. Roth*[1], Jianhua Yao[1], Le Lu[1], James Stieger[1], Joseph E. Burns[2], and Ronald M. Summers[1]

[1]Imaging Biomarkers and Computer-Aided Diagnosis Laboratory,, Radiology and Imaging Sciences, National Institutes of Health Clinical Center, Bethesda, MD 20892-1182, USA.
[2]Department of Radiological Sciences, University of California-Irvine, Orange, CA 92868, USA.

normal controls). The proposed method reduces the number of FP/vol. from 4 to 1.2, 7 to 3, and 12 to 9.5 when comparing a sensitivity rates of 60%, 70%, and 80% respectively in testing. The Area-Under-the-Curve (AUC) is 0.834. The results show marked improvement upon previous work.


True Positive: p = 0.90
True Positive: p = 0.99
True Positive: p = 0.82
True Positive: p = 0.96
True Positive: p = 0.78
True Positive: p = 0.98
True Positive: p = 0.94
True Positive: p = 0.93
True Positive: p = 0.95
True Positive: p = 0.85
True Positive: p = 0.78
True Positive: p = 0.80
True Positive: p = 0.90
True Positive: p = 0.98
True Positive: p = 0.99

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SIIM 2018 ANNUAL MEETING
INSPIRING COLLABORATION
May 31 – June 2 | Gaylord National Resort | National Harbor, MD

Artificial Intelligence for the Interpretation of Musculoskeletal MR Images

Giuseppe Marbach, PhD, Data Scientist, Balzano Informatik AG, Zürich; René Balzano, MSc

Outcome

We trained our AI models with 12,000 MR studies (images and reports) for the meniscus region and have reached an accuracy of 75% on a test set of 800 studies, see Tab-1.

	precision	recall	test data
pos	0.72	0.74	359
neg	0.78	0.76	441
average total	**0.75**	**0.75**	**800**

Tab-1: Accuracy for meniscus tears on our test set

Deep Learning Approach for Evaluating Knee MR Images: Achieving High Diagnostic Performance for Cartilage Lesion Detection

Fang Liu ✉, Zhaoye Zhou, Alexey Samsonov, Donna Blankenbaker, Will Larison, Andrew Kanarek, Kevin Lian, Shivkumar Kambhampati, Richard Kijowski

Published Online: Jul 31 2018 | https://doi.org/10.1148/radiol.2018172986

Abstract

Purpose

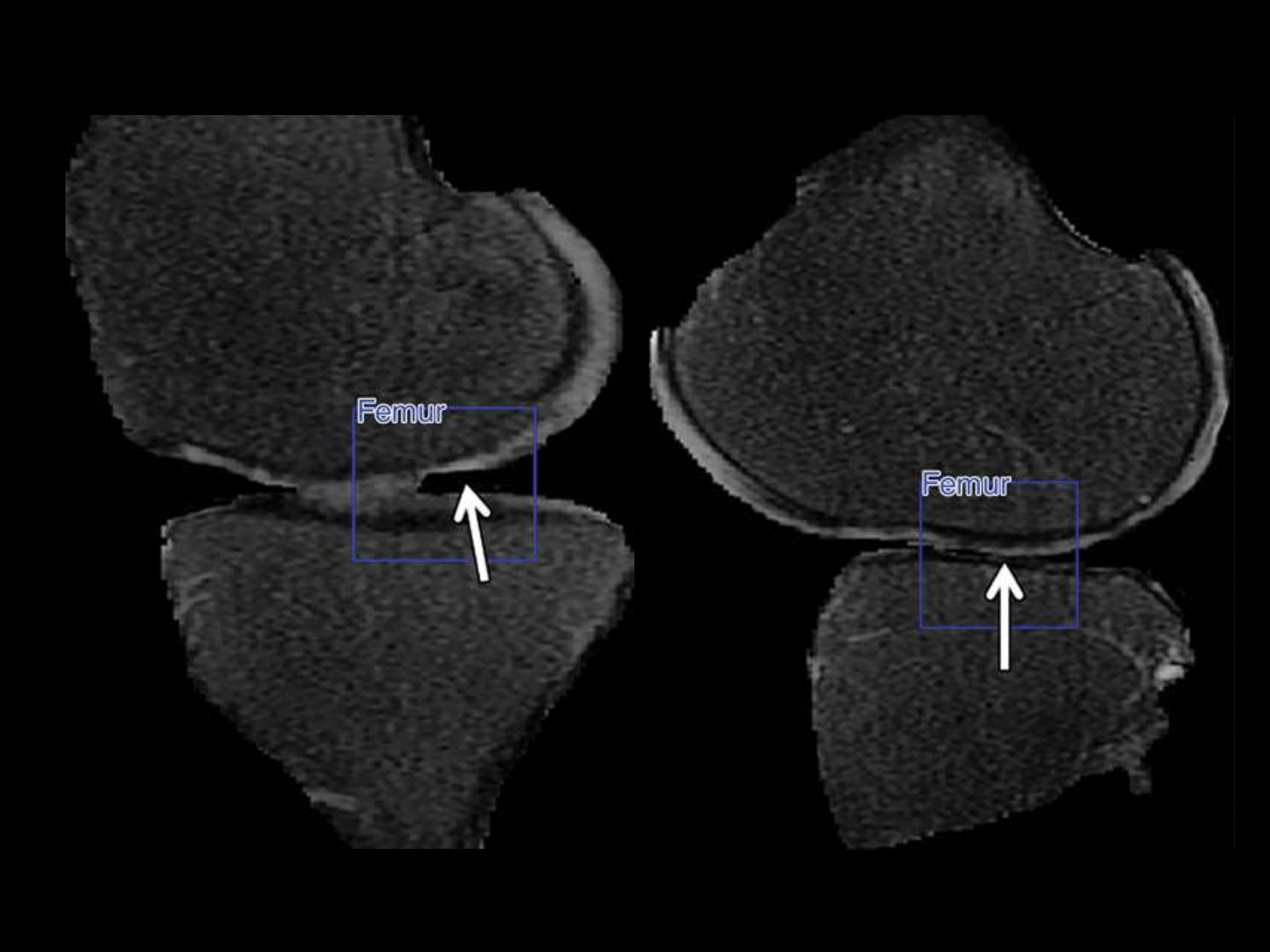
To determine the feasibility of using a deep learning approach to detect cartilage lesions (including cartilage softening, fibrillation, fissuring, focal defects, diffuse thinning due to cartilage degeneration, and acute cartilage injury) within the knee joint on MR images.

Results

The sensitivity and specificity of the cartilage lesion detection system at the optimal threshold according to the Youden index were 84.1% and 85.2%, respectively, for evaluation 1 and 80.5% and 87.9%, respectively, for evaluation 2. Areas under the ROC curve were 0.917 and 0.914 for evaluations 1 and 2, respectively, indicating high overall diagnostic accuracy for detecting cartilage lesions. There was good intraobserver agreement between the two individual evaluations, with a κ of 0.76.

Conclusion

This study demonstrated the feasibility of using a fully automated deep learning–based cartilage lesion detection system to evaluate the articular cartilage of the knee joint with high diagnostic performance and good intraobserver agreement for detecting cartilage degeneration and acute cartilage injury.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PLoS One. 2014; 9(4): e94917.
PMCID: PMC3986413
Published online 2014 Apr 14. doi: [10.1371/journal.pone.0094917]
PMID: 24733553

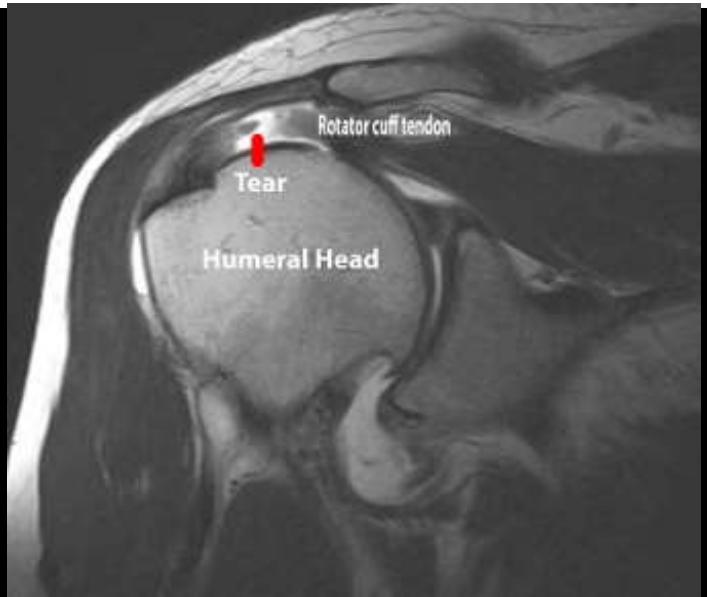
Predicting Rotator Cuff Tears Using Data Mining and Bayesian Likelihood Ratios

Hsueh-Yi Lu, [1] Chen-Yuan Huang, [1] Chwen-Tzeng Su, [1] and Chen-Chiang Lin [2,*]

Vince Grolmusz, Editor

Conclusions

Our predictive data mining models, combined with likelihood ratios and Bayesian theory, appear to be good tools to classify rotator cuff tears as well as determine the probability of the presence of the disease to enhance diagnostic decision making for rotator cuff tears.



Next steps…

- Exploratory
- Test pilot with annotated database
- Potential to harness the huge PACS database partnering with UCLan- Prof Bogdan and team