ESPR
European Society of Paediatric Radiology

Assessment of an AI aid in detection of pediatric appendicular skeletal fractures by senior and junior radiologists

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GLEAMER

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Conflicts of interest

- Consulting missions for Gleamer

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Background

- Few articles studying fracture detection in pediatric population
- Only about elbow fractures : encouraging results (Se 0,91-0,93, Sp 0,84-0,92) but
  - Low PPV : sorting role
  - Standalone studies

DATASET CONSTITUTION

1 US-based data provider

Inclusion of
- Anonymized standard X-ray exams of limbs with or without fracture(s)
- Pediatric patient, age between 2 to 21

Exclusion of :
- Exams with one or more images including a body part not concerned by the intended use of BoneView (pelvis, skull, spine, rib cage)
- Poor quality exams
- Cases not containing a sufficient number of views for diagnosis.

300 exams

50% with fractures

60 per body part


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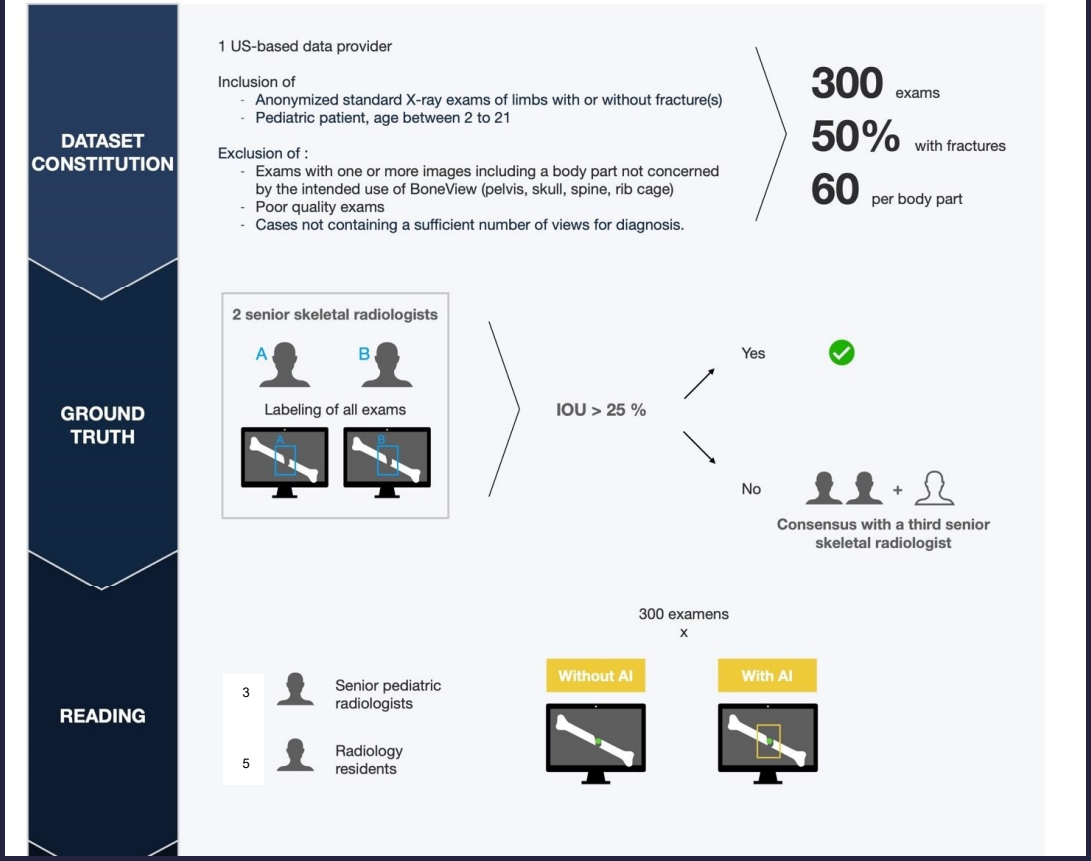
GROUND TRUTH
2 senior skeletal radiologists
A
B
Labeling of all exams
IOU > 25 %
Yes
No
+
Consensus with a third senior skeletal radiologist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READING
300 examens
x
Without AI
With AI
3
Senior pediatric radiologists
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Radiology residents

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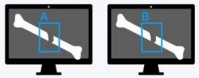

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300 examens
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Without AI

With AI

ANALYSIS

- Patient-wise sensitivity
- Lesion-wise sensitivity
- Specificity
- Per patient false positive rate with fractures
- Per patient false positive rate without fractures

- By readers' level
- By body part
- By age
- By fracture type

Results

	Unaided	Aided	Absolute difference
SE_{PW}	73.17	82.67	9.5 [7.05, 11.95] (p<0.001)
SPE_{PW}	89.58	90.33	0.75 [-0.75, 2.25] (p=0.28)

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	Unaided	Aided	Absolute difference
residents ($N_{readers}$=5)	N = 300	N = 300	
SE_{PW}	71.73	82.0	10.27 [7.81, 12.72] (p< 0.001)
SPE_{PW}	86.27	87.6	1.33 [-1.28, 3.95] (p=0.23)
experts ($N_{readers}$=3)	N = 300	N = 300	
SE_{PW}	75.56	83.78	8.22 [-2.42, 18.87] (p=0.08)
SPE_{PW}	95.11	94.89	-0.22 [-1.18, 0.73] (p=0.42)

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	Unaided	Aided	Absolute difference
hand/wrist	68.75	87.08	18.33 [10.74, 25.93] (p<0.001)
arm	83.33	89.58	6.25 [3.92, 8.58] (p<0.001)
shoulder	96.25	98.33	2.08 [-0.47 4.64] (p=0.09)
knee/leg	63.75	67.5	3.75 [0.99, 6.51] (p=0.01)
foot/ankle	53.75	70.83	17.8 [10.35, 23.82] (p<0.001)

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Results

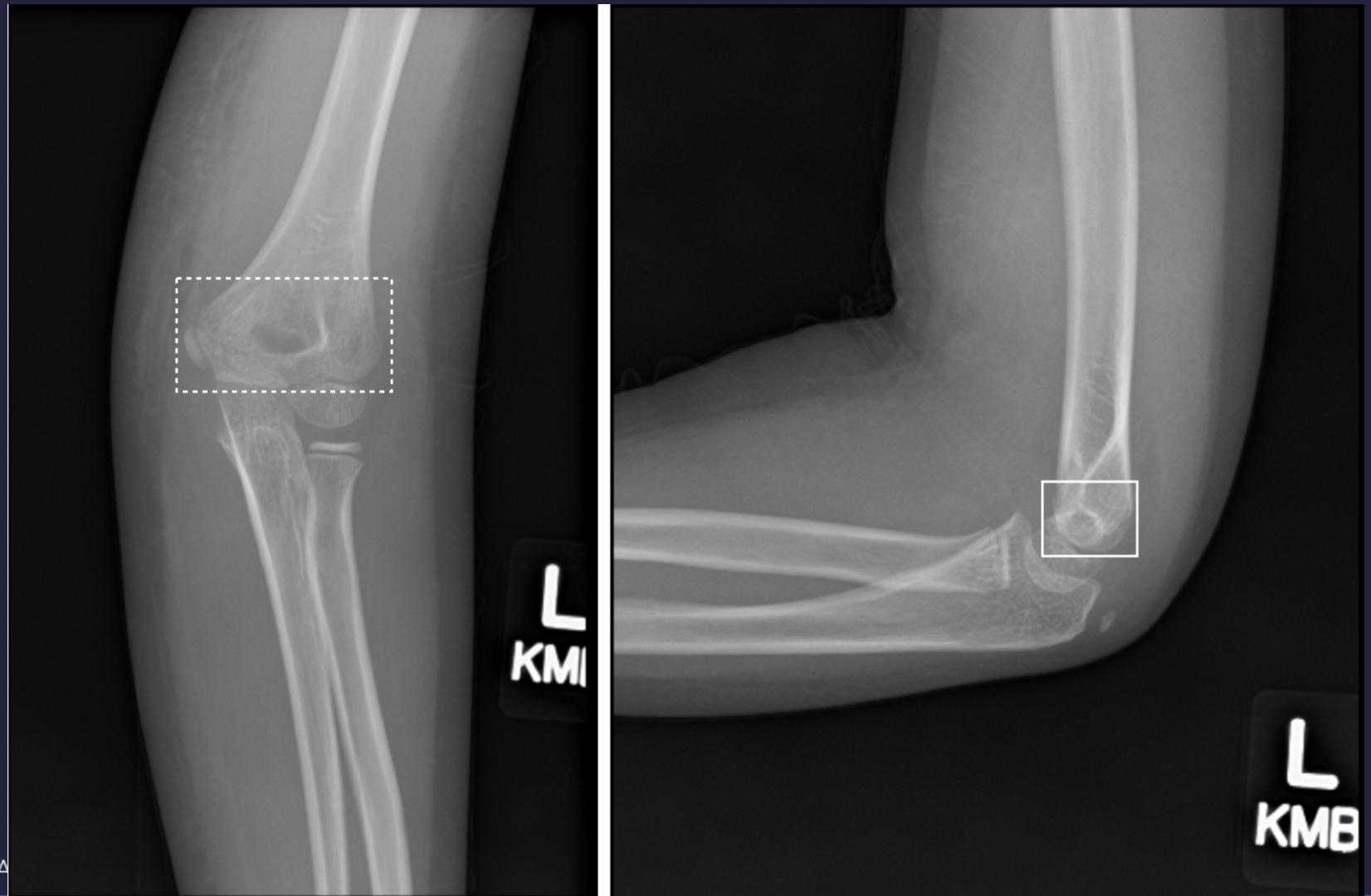
	Unaided	Aided	Absolute difference
Obvious	N_{fract} = 125	N_{fract} = 125	
SE_{FW}	83.8	90.9	7.1 [4.61, 9.59] (p<0.001)
Non-obvious	N_{fract} = 48	N_{fract} = 48	
SE_{FW}	52.34	66.67	14.32 [10.11, 18.53] (p<0.001)

Discussion

- Significant increase in sensitivity for all readers (73% to 83%, p < 0,001)
  - All anatomical locations
  - All types of factures, including pediatric-specific fractures
  - Greater in cases of non-obvious fractures
- No decrease in specificity

Discussion

- First study about the peformance of the AI help for radiologists in pediatric population
- In pediatric population (England et al, AJR, 2018) : standalone study, similar results
- Duron et al, Radiology, 2021 : adult population, similar results. Improvement of sensitivity from 70.7% to 79.4%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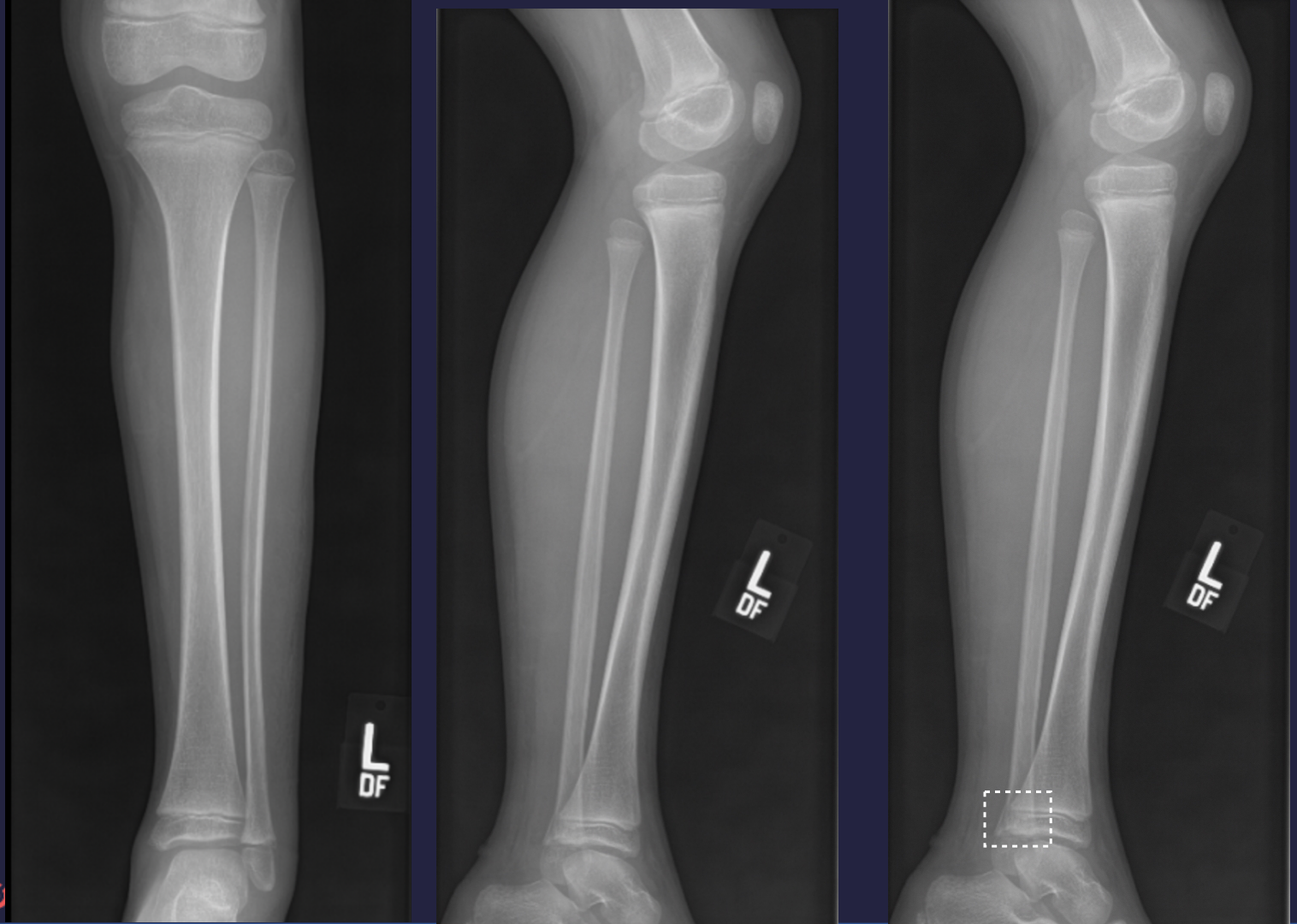
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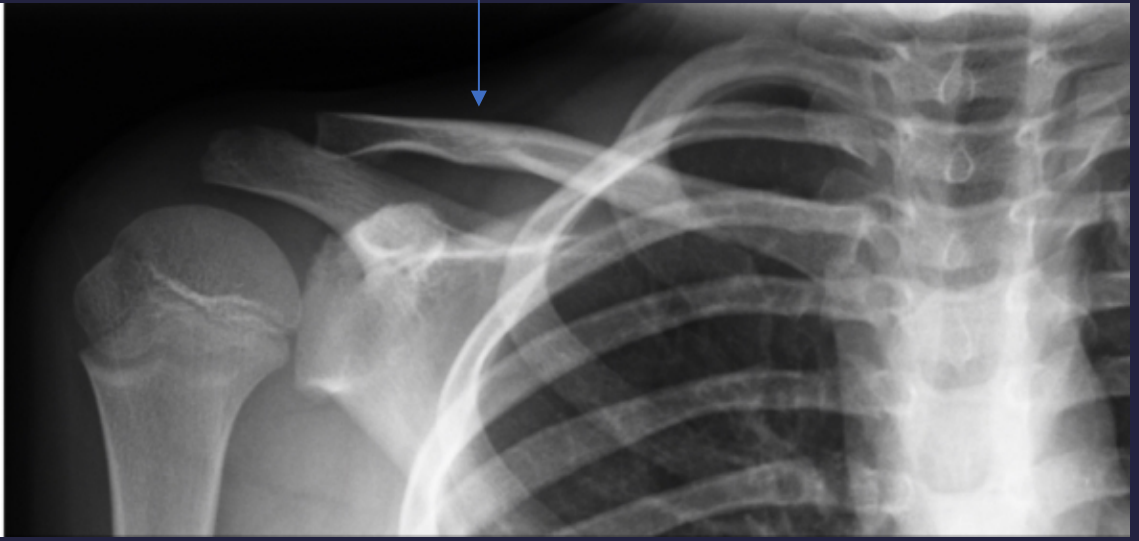


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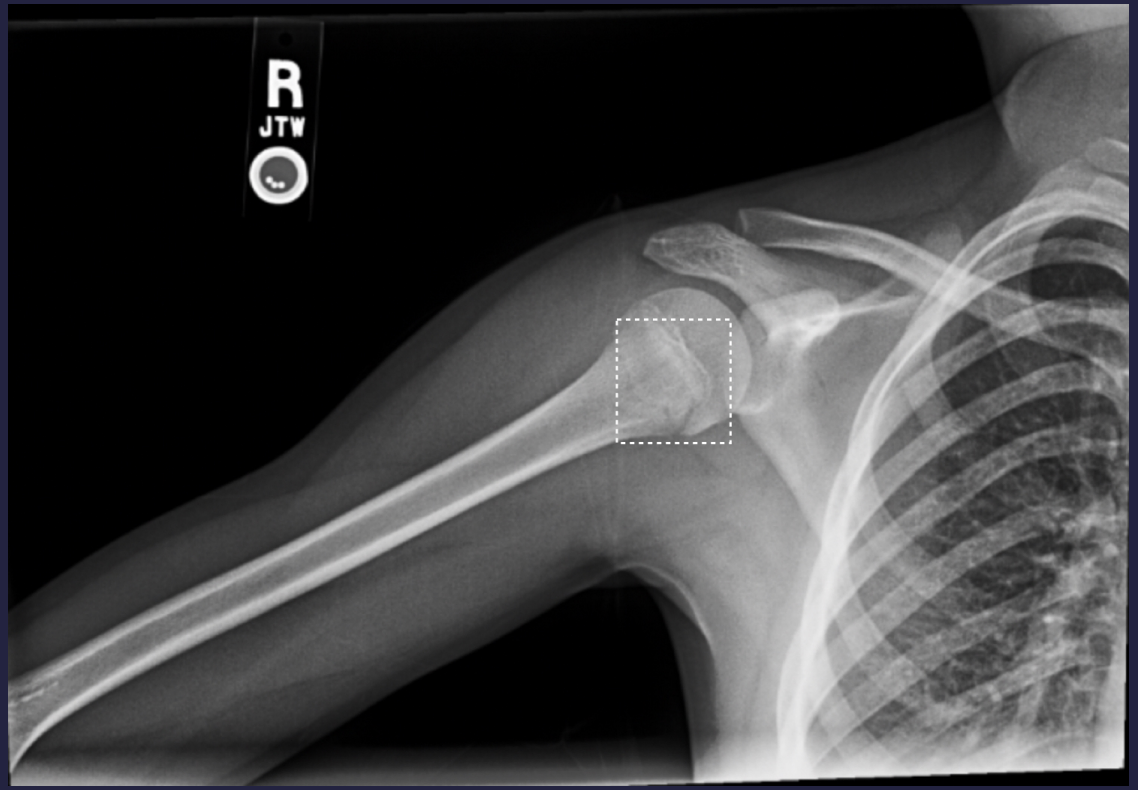
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Limitations

- Retrospective study
- Dataset artificially constituted
- Artificial reading conditions : cognitive bias
- No clinical informations : context bias

Conclusion

- Average increase in sensitivity of 9.5 %
- Greater increase among junior radiologists
- Greater increase in non-obvious fractures
- No decrease in specificity

- Needs confirmation by a larger scale study

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