Pediatric Bone Age Assessment using Deep Neural Networks

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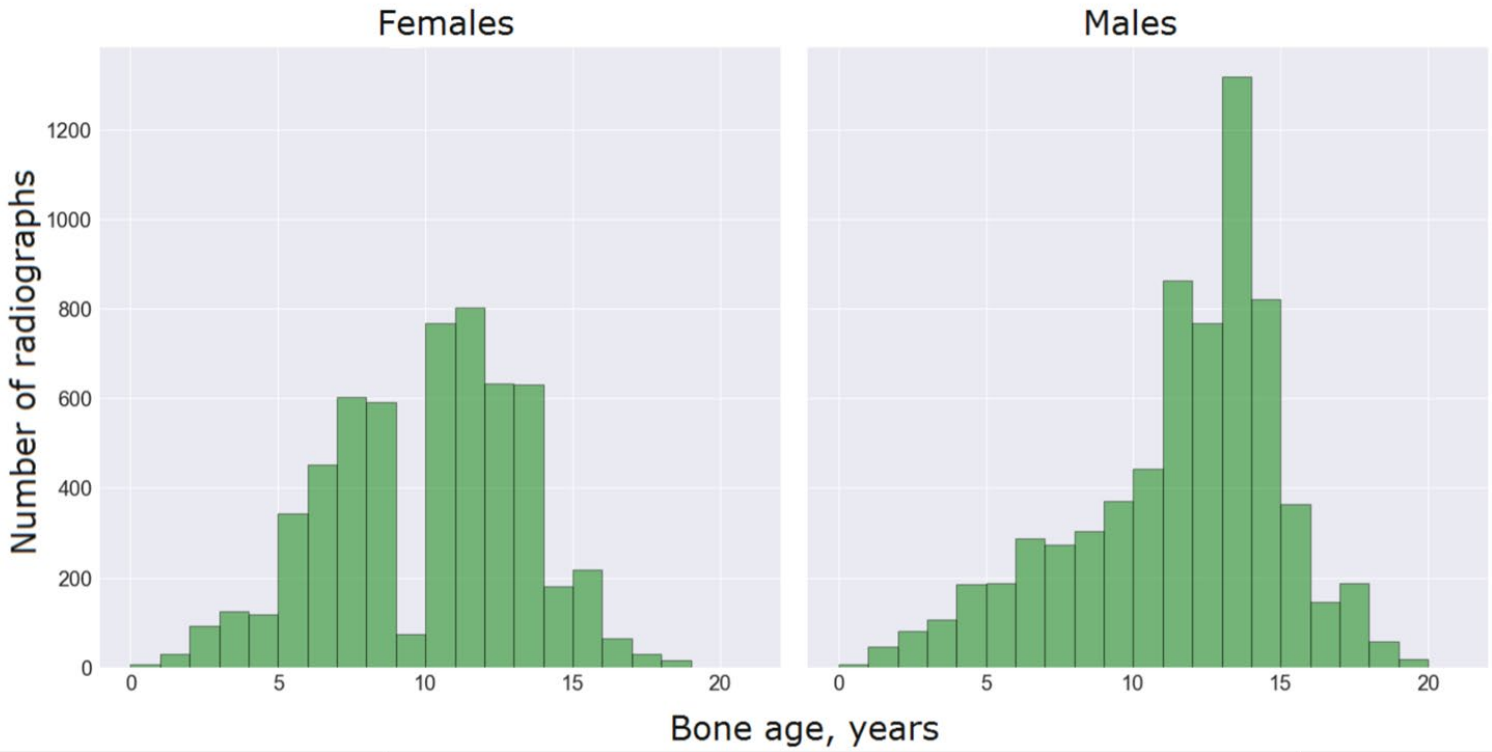
Purpose

- During a child’s development, the bones of a skeleton change in size and shape
- Bone age is often requested by pediatricians for comparison with chronological age for diagnosing diseases which result in tall or short stature in children, among other abnormalities

About The Data

- To increase the implementation of AI in radiology, the Radiological Society of North America created a contest in 2017 to try and correctly identify the age of a child based on an X-ray of their left hand
- A CSV provides 12,611 observations with an ID number, actual bone age (in months for greater accuracy), and sex, while a separate folder contains the corresponding 12,611 X ray images

	id	boneage	male
0	1377	180	False
1	1378	12	False
2	1379	94	False
3	1380	120	True
4	1381	82	False
5	1382	138	True
6	1383	150	True
7	1384	156	True
8	1385	36	True
9	1387	138	True


Females
Males
Number of radiographs
0
200
400
600
800
1000
1200
0
5
10
15
20
Bone age, years

Our Goals

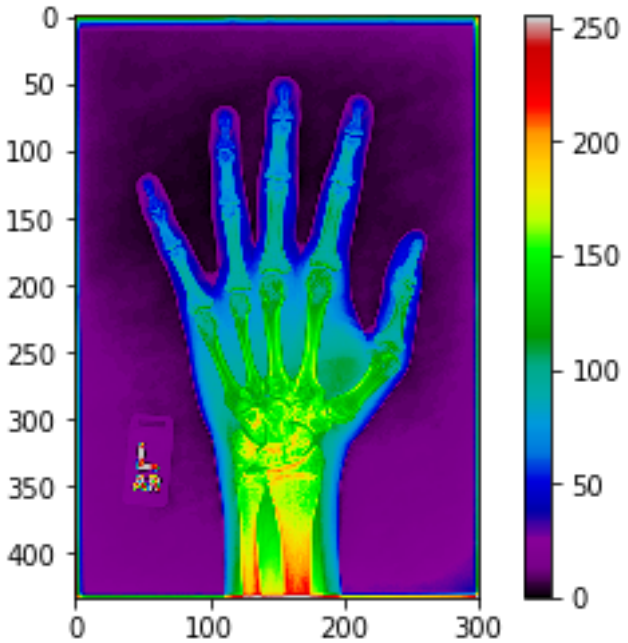
Uses of bone age assessment:

- Estimate the maturity of a child's skeletal system
- Look at the actual age of the child combined with our own predictions
- Determine if there are any signs of growth problems

We are working through a previously-made kernel on Kaggle to try to replicate his findings and use them as inspiration for our own ideas

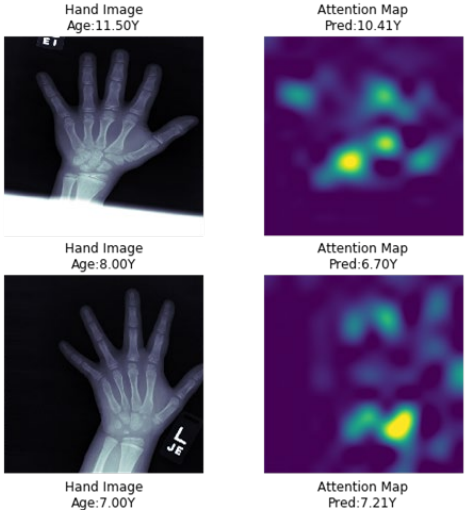
Preliminary Experiment: Pixel Intensity/Attention Maps

- Pixel intensity equates to the brightness of a particular pixel
  - Stored as one-byte unsigned characters 0-255
  - 0=black 255=white
- The location of soft tissue could be an indicator of someone's relative age
- We are trying to see if pixel intensity at soft tissue locations correlate with the results of the attention maps



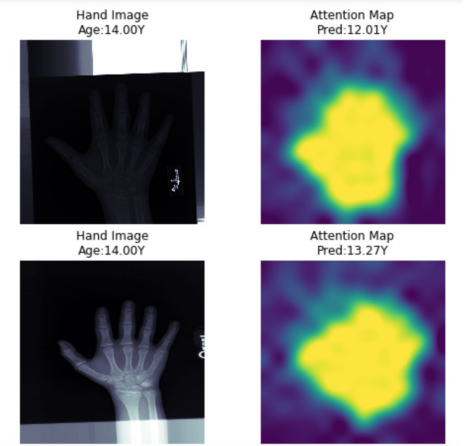
Attention Map

- Attention maps pinpoint the most important parts of the image to look at
  - With very complex code
- We are working to refine our model to match the accuracy of the guidance kernel (pictured here)
  - Is the attention model better than the pixel intensity model?



← Guidance kernel

Our model →



Next Steps

Scaling images

- Downscale images to reduce computational costs
- Input augmentations: rotation, translation, and zoom

Pixel intensity

- Compare to attention maps to see if there is correlation between the two/if the same areas are highlighted