MIME
Master's degree ICT Internet Multimedia Engineering

# PROJECT C2

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

DIPARTIMENTO MATEMATICA

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UNIVERSITÀ DEGLI STUDI DI PADOVA

# Project no. C2 “bone age prediction from hand radiographs”

## Reference papers

[Larson18] D. B. Larson, M. C. Chen, M. P. Lungren, S. S. Halabi, N. V. Stence, C. P. Langlotz, Performance of a Deep-learning neural network Model in assessing skeletal Maturity on Pediatric hand radiographs, Radiology, vol. 287, no. 1, pp. 313-322, April 2018.

[Halabi19] S. S. Halabi *et al.*, The RSNA Pediatric Bone Age Machine Learning Challenge, Radiology, vol. 290, pp. 498-503, 2019.

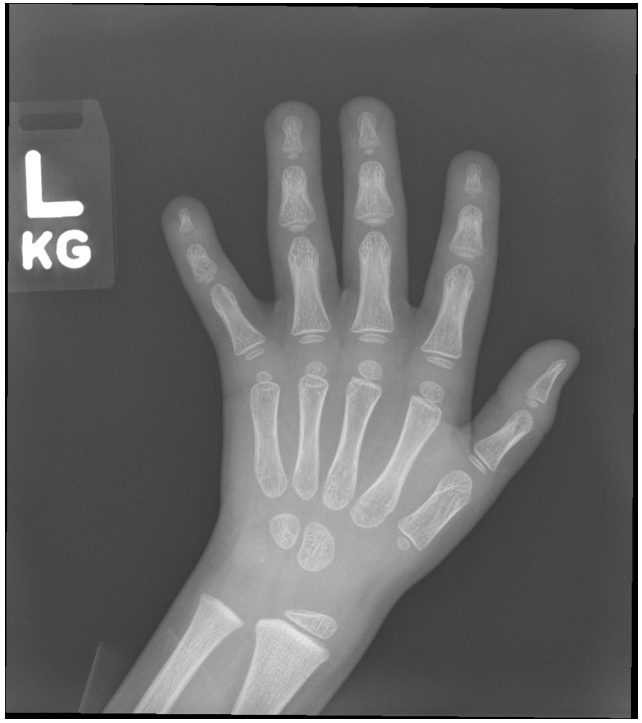
https://www.rsna.org/en/education/ai-resources-and-training/ai-image-challenge/RSNA-Pediatric-Bone-Age-Challenge-2017

## Dataset (10.3 GB uncompressed)

https://stanfordmedicine.app.box.com/s/4r1zwio6z6lrzk7zw3fro7ql5mnoupcv/folder/42459416739

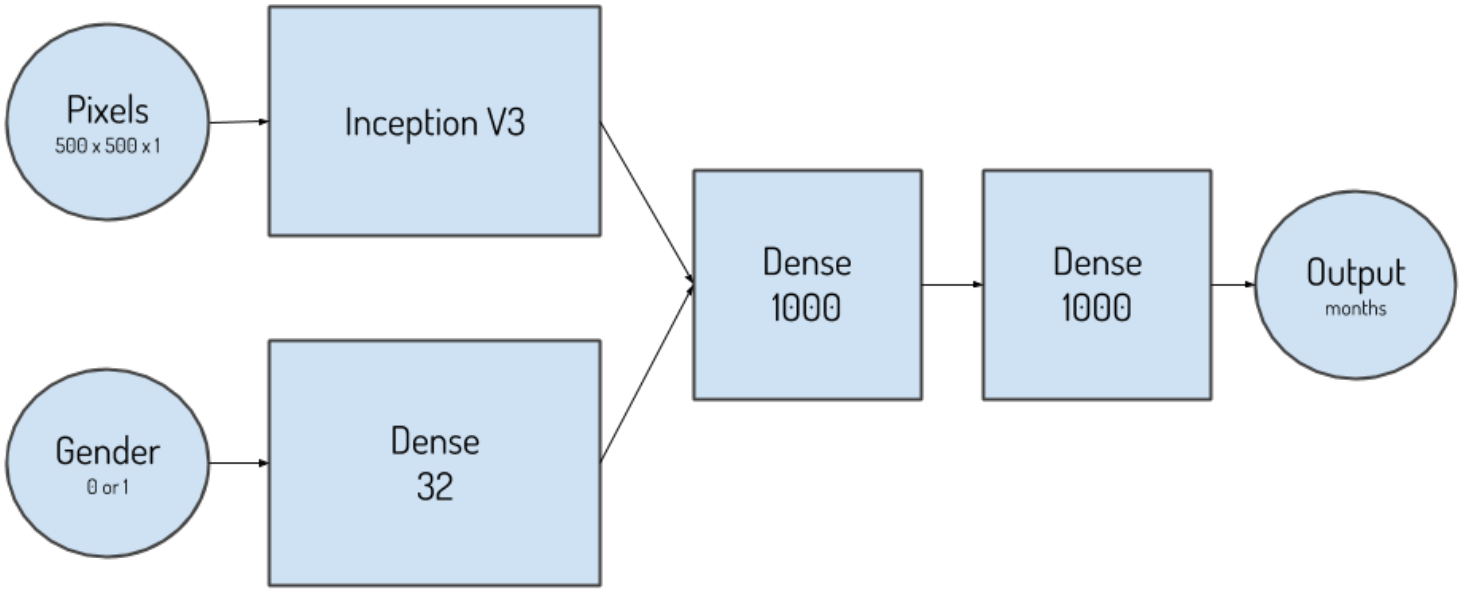
# Dataset description

- 12,612 training hands' X-ray images (digital and scanned) from two U.S. hospitals
- CSV file containing the age (to be predicted) and the gender (useful additional information)

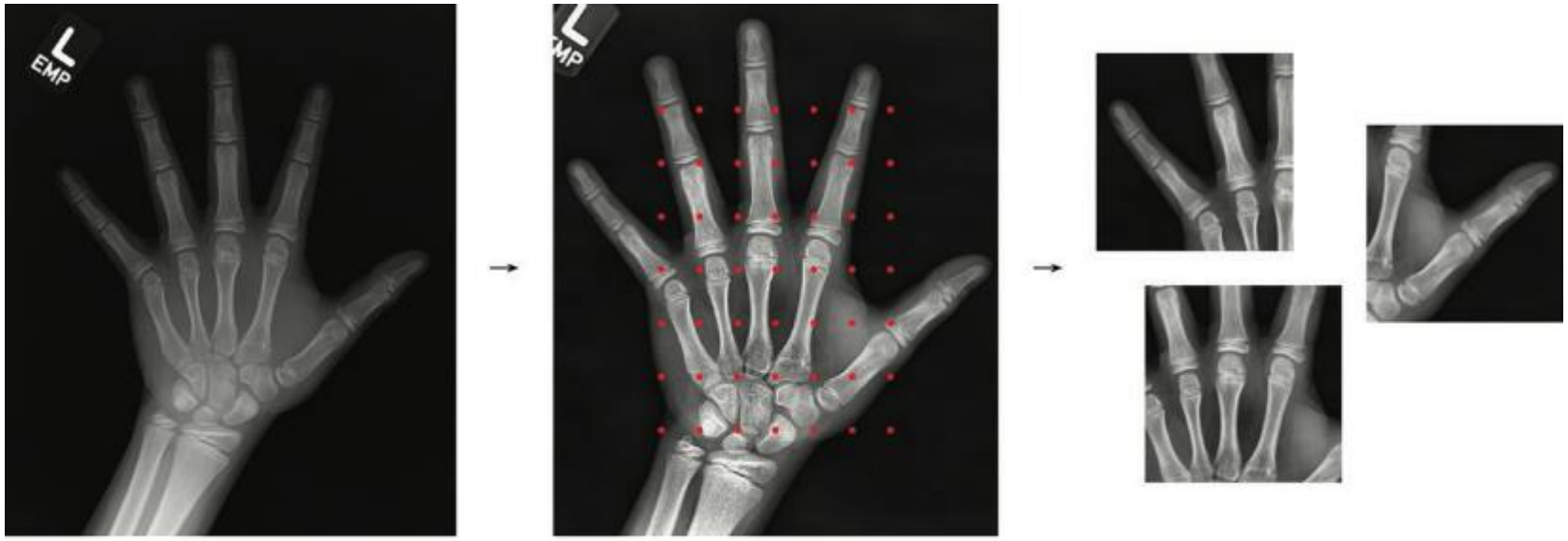

# Winner model from [Halabi19]

- https://www.16bit.ai/blog/ml-and-future-of-radiology
- The age is predicted with an accuracy of 4 months



# Second-place model from [Halabi19]

- Gender-specific models
- Each image was divided into 49 overlapping patches
- Use ResNet-50



Original Raw Image

Cropped + Resized + CLAHE

Each red point represents the center of an extracted patch.

Each patch is used as a training example for the CNN.

# Possible project developments

- Solve the bone age prediction as a regression or classification task
  - as input: use row images or extract features
  - as output: use the age value (for regression) or classes of ages (for classification)
  - assess the importance of the gender information into the classification
  - possible idea: classify the entire image or use subpatches and then apply a decision fusion mechanism
- Architectures
  - different possibilities: CNN, RNN, attention, …