



Bone Age Prediction

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Introduction



A bone age study helps doctors estimate the maturity of a child's skeletal system. It's usually done by taking a single X-ray of the left wrist, hand, and fingers.

A child's bone age (also called the skeletal age) is assigned by determining which of the standard X-ray images in the atlas most closely match the appearance of the child's bones on the X-ray.

Problem Statement & Motivation



In this project we aim to train a model on the x-ray images of childrens hands and predict the bone age of children, by doing so we can find any abnormalities in the growth of a child's bone and also find difference between a child's bone age and his or her chronological age which might indicate a growth problem

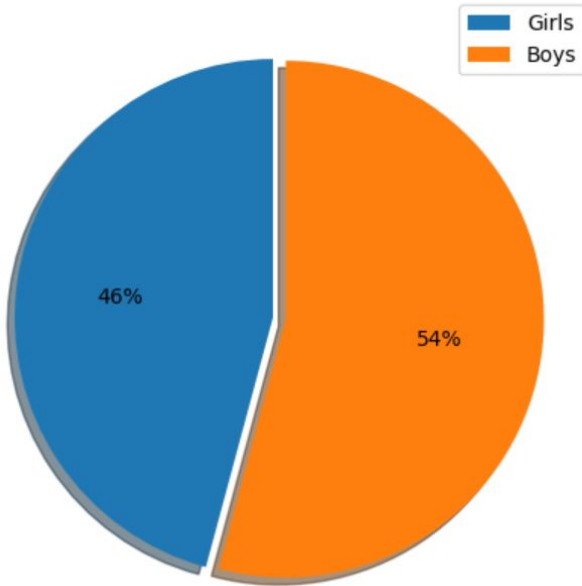
Data set description



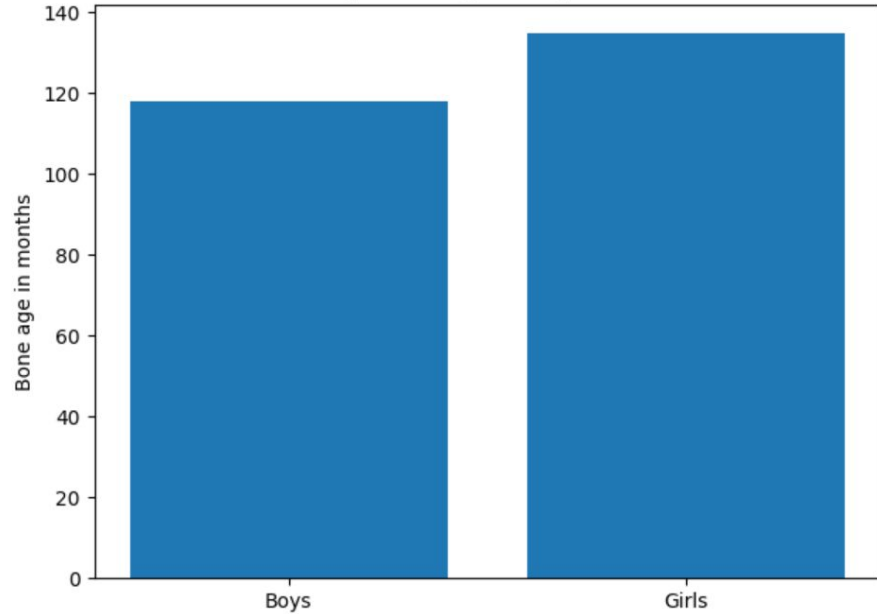
- The data set is obtained from kaggle and holds 9 GB of data.
- A total of 12611 images are available.
- Good resolution images (1514*2044 pixels)
- .CSV file which has image id, bone age, gender

Exploratory data analysis

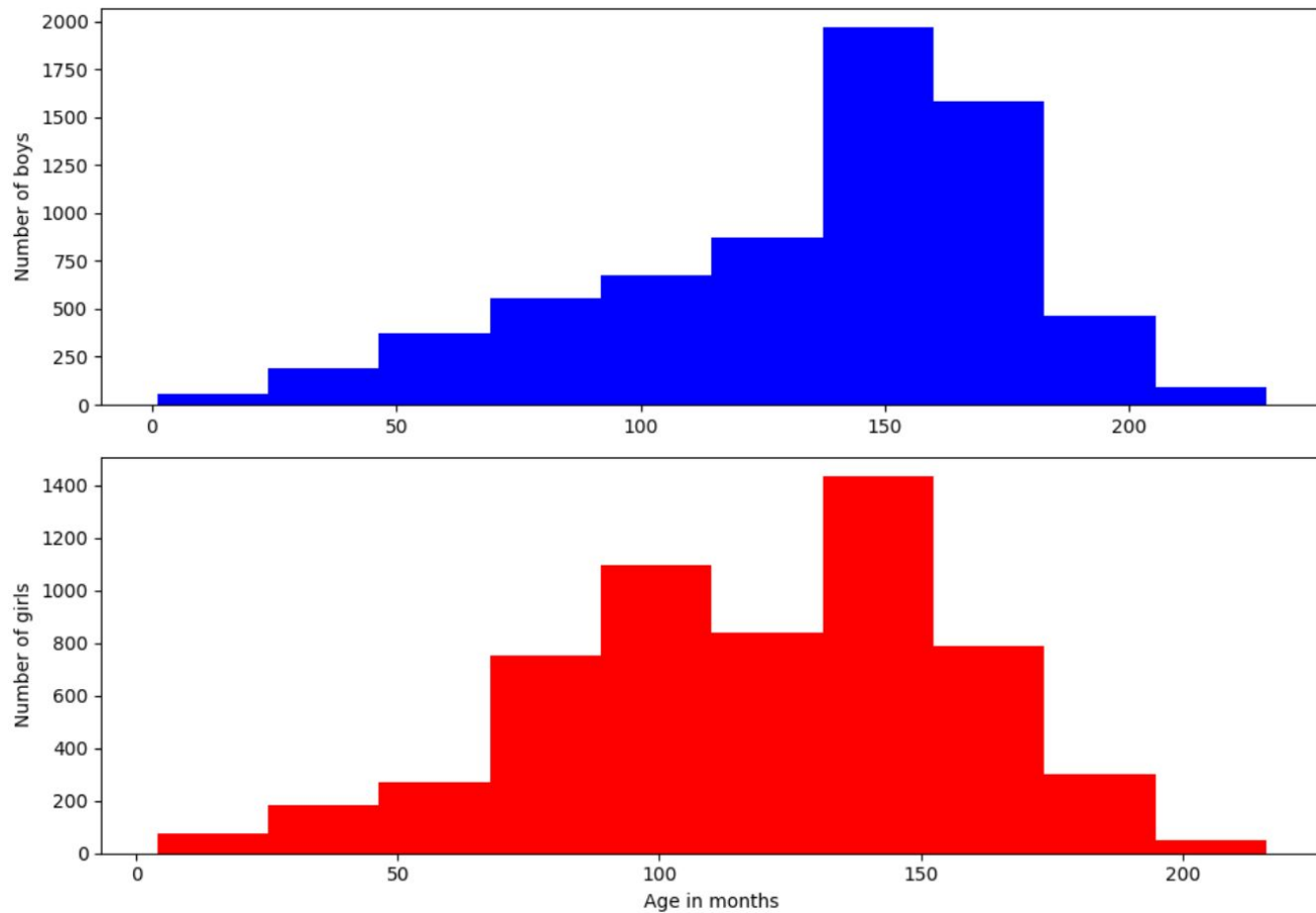
Percentage of Boys and Girls



Average bone age of Boys and Girls



EDA Contd..



Glimpse into the dataset



Image 1

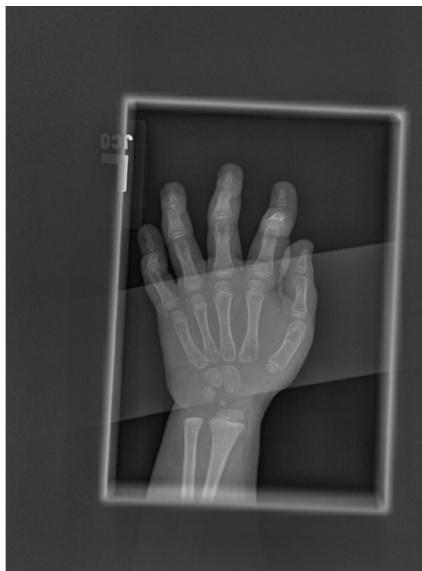


Image 2



Image 3



Image 4

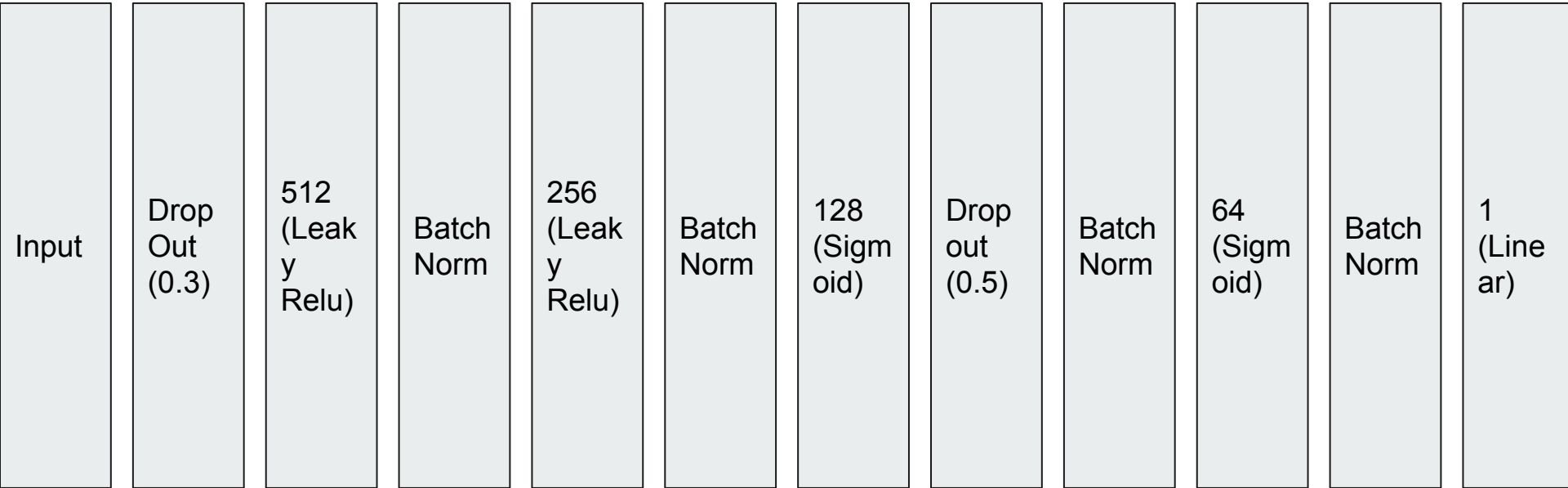
Image data generator



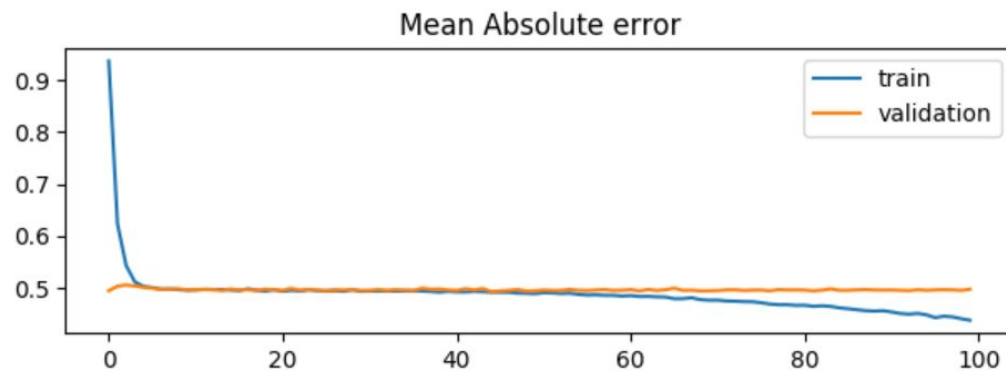
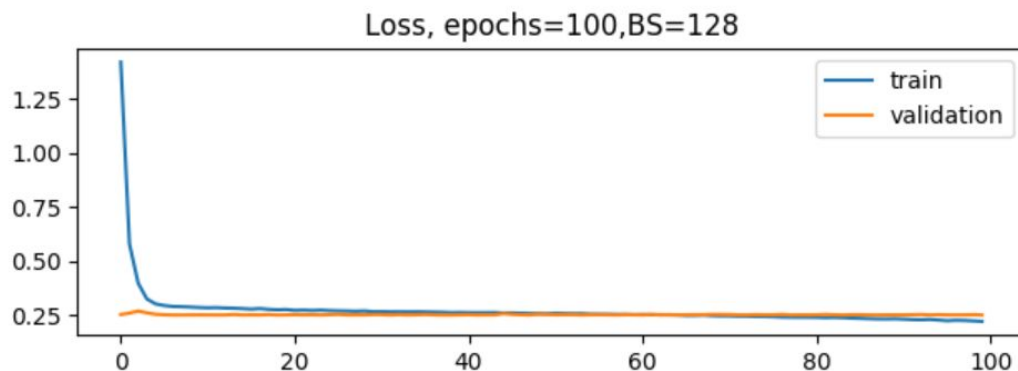
Parameters used:

rotation_range=20,
width_shift_range=0.2,
height_shift_range=0.2,
zoom_range=0.3,
horizontal_flip=True,
brightness_range=[0.5, 1]

Preliminary model Architecture



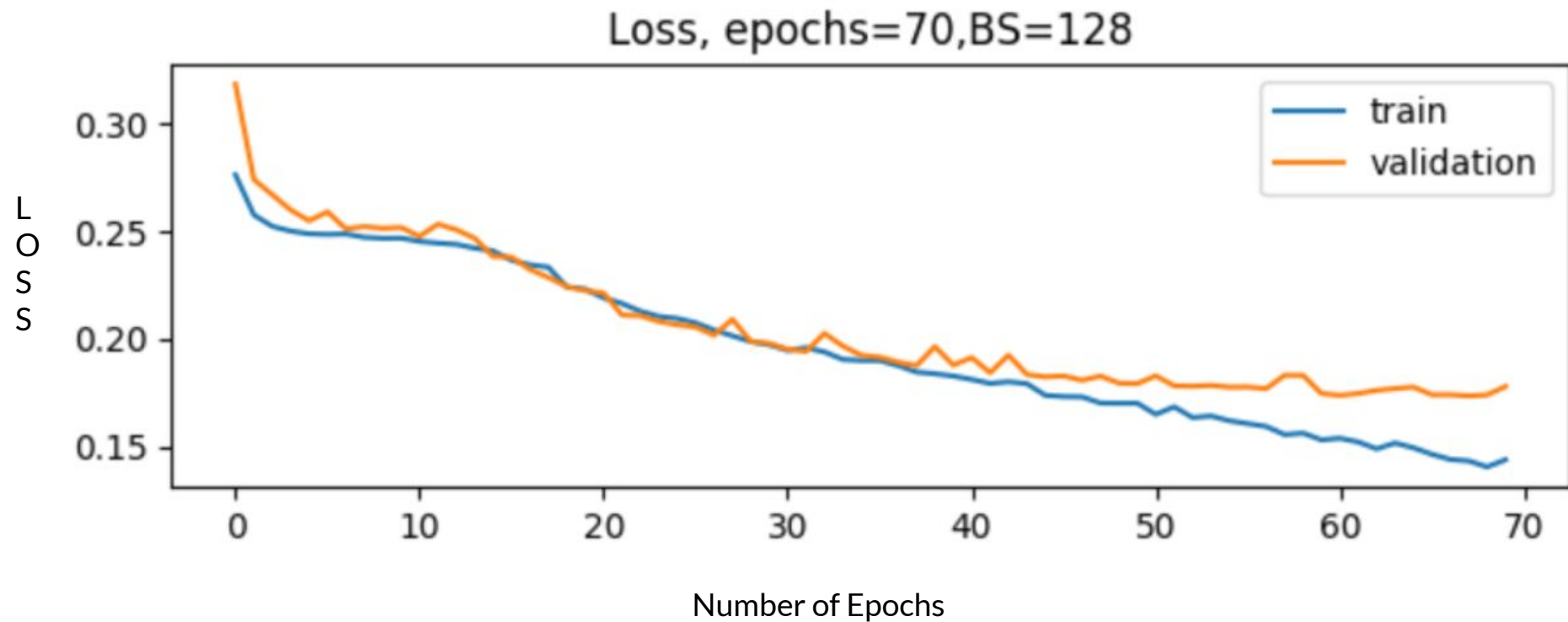
Preliminary model results



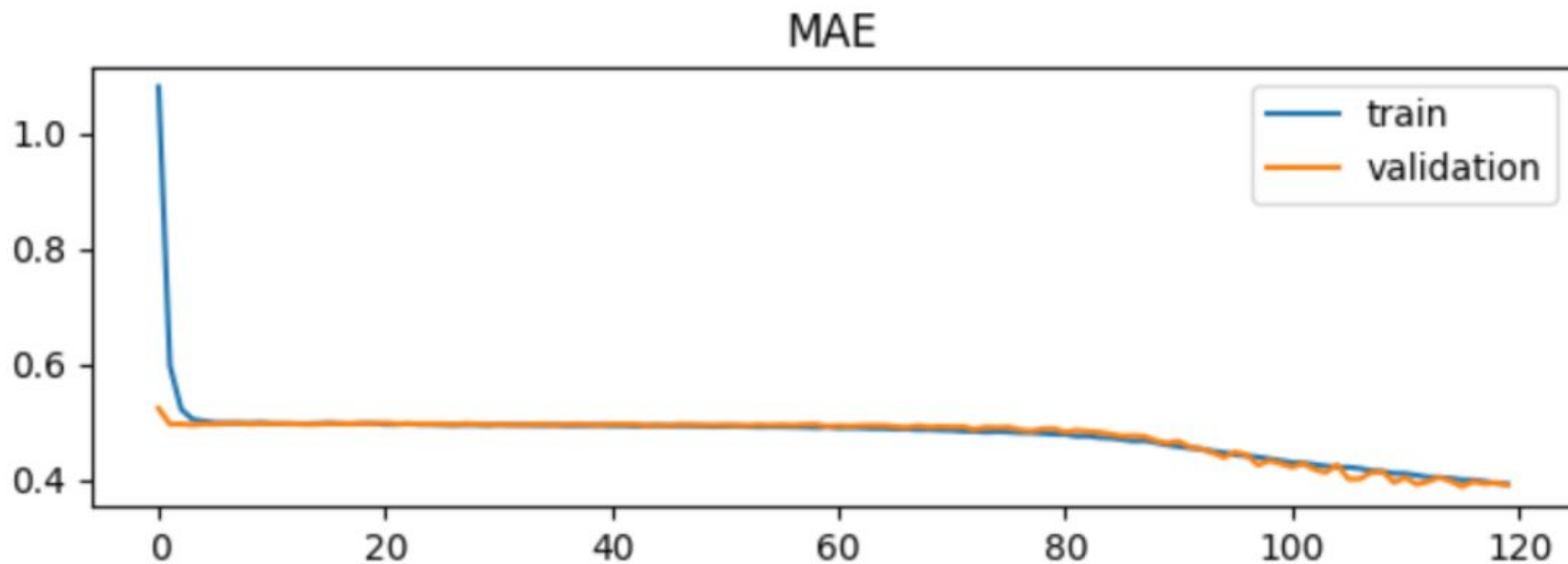
CNN Model

Layer (type)	Output Shape	Param #
conv2d_7 (Conv2D)	(None, 50, 50, 32)	896
conv2d_8 (Conv2D)	(None, 48, 48, 32)	9248
max_pooling2d_4 (MaxPooling2D)	(None, 24, 24, 32)	0
dropout_7 (Dropout)	(None, 24, 24, 32)	0
conv2d_9 (Conv2D)	(None, 24, 24, 64)	18496
conv2d_10 (Conv2D)	(None, 22, 22, 64)	36928
max_pooling2d_5 (MaxPooling2D)	(None, 11, 11, 64)	0
dropout_8 (Dropout)	(None, 11, 11, 64)	0
conv2d_11 (Conv2D)	(None, 11, 11, 128)	73856
conv2d_12 (Conv2D)	(None, 9, 9, 128)	147584
max_pooling2d_6 (MaxPooling2D)	(None, 4, 4, 128)	0
dropout_9 (Dropout)	(None, 4, 4, 128)	0
flatten_3 (Flatten)	(None, 2048)	0
dense_8 (Dense)	(None, 512)	1049088
dropout_10 (Dropout)	(None, 512)	0
dense_9 (Dense)	(None, 1)	513

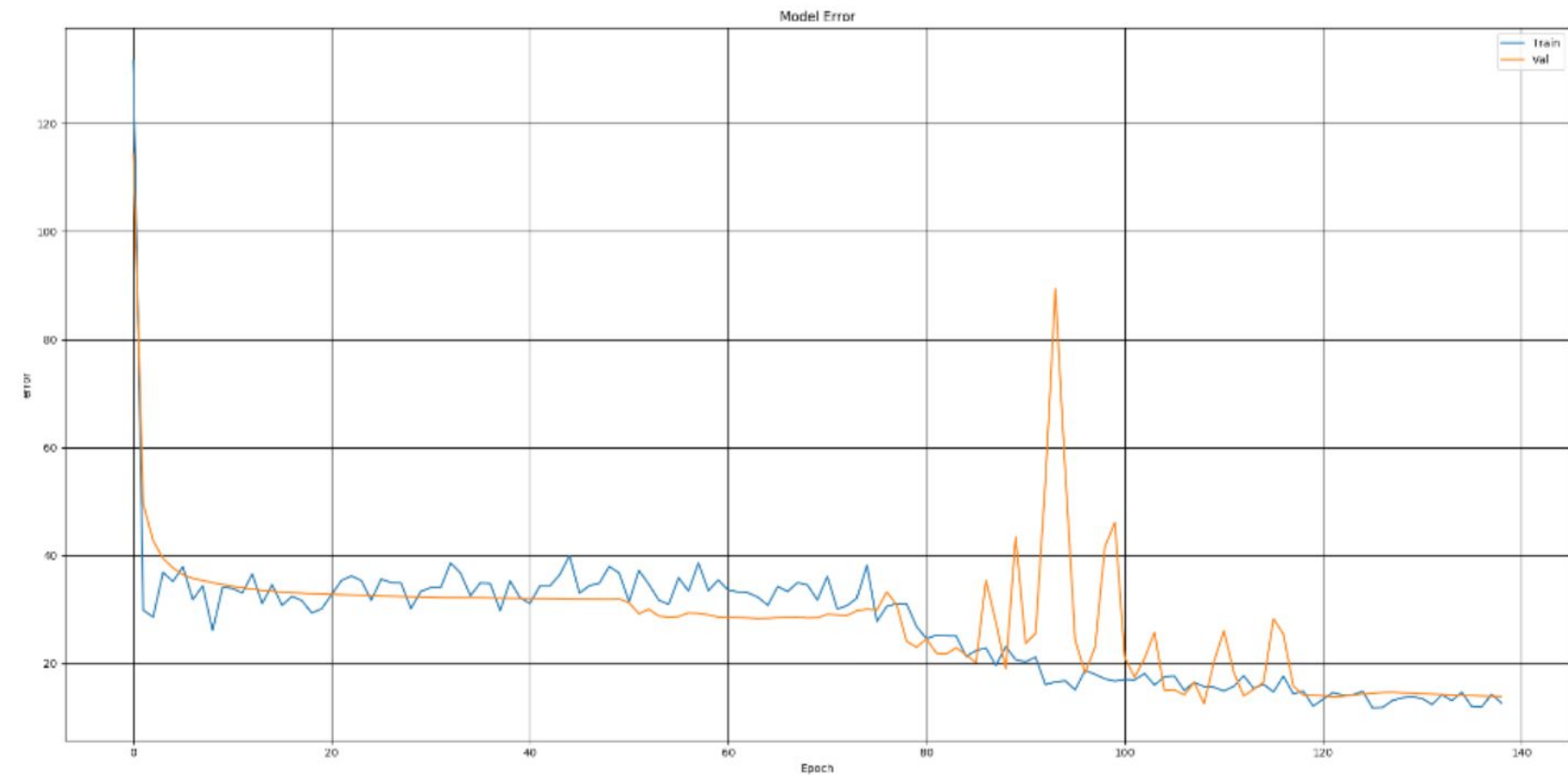
CNN results



Train vs validation Mean absolute error



Xception Pre trained model



Conclusions



- The simple MLP model had a validation loss of 0.25, validation MAE of 0.49, and validation MSE of 0.24
- The CNN model has a validation loss of 0.17, validation MAE of 0.34 and validation MSE of 0.18
- The Xception model has a validation loss of 0.15, MAE in months is 13.9
- The Pre trained model had the least loss when compared among all the models

Future work



- We would like to use the gender information as well for training and see how it impacts the results
- Use different pre-trained models to our data and experiment
- Convert the bone age data into appropriate bins and build a model



THANK YOU...!