Capstone 3 presentation

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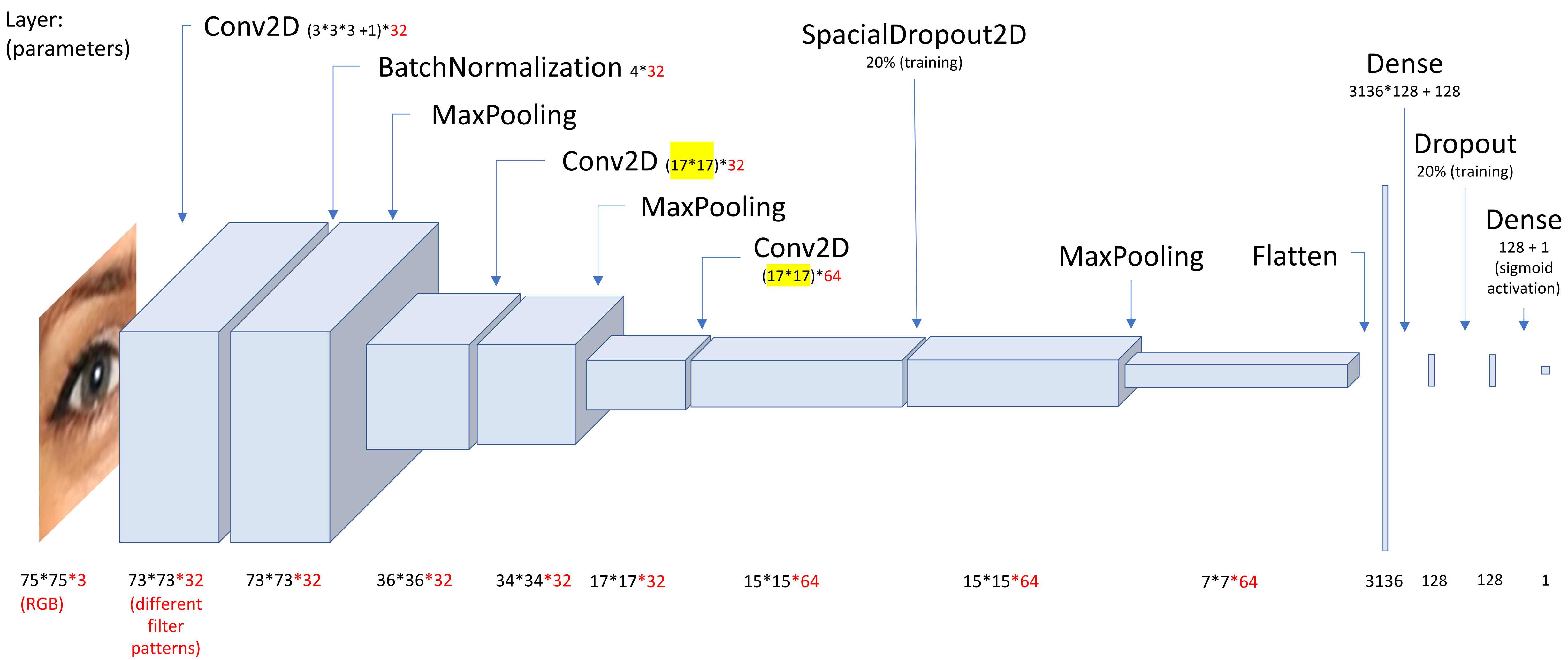
Male or Female eyes?

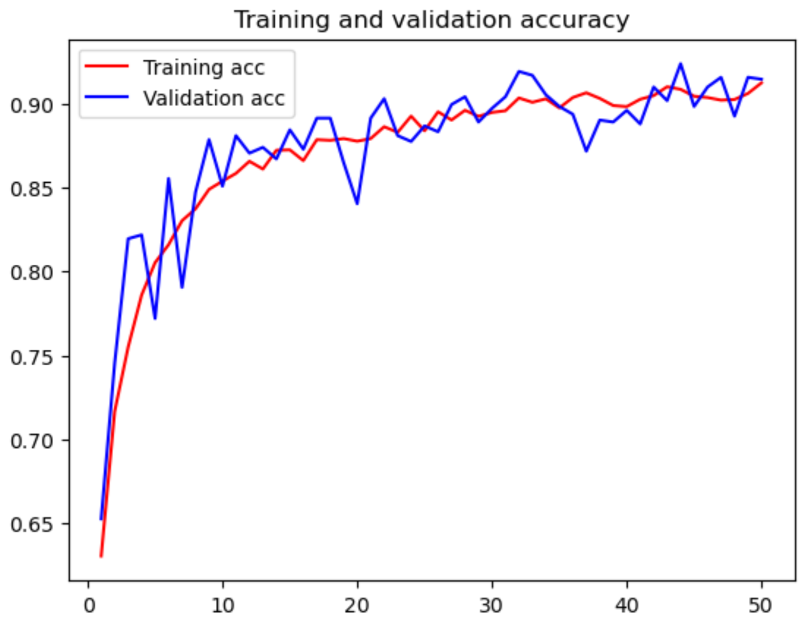
- https://www.kaggle.com/pavelbiz/eyes-rtte
  - femaleeyes folder with 5202 images
  - maleeyes folder with 6323 images
  - 42MB total

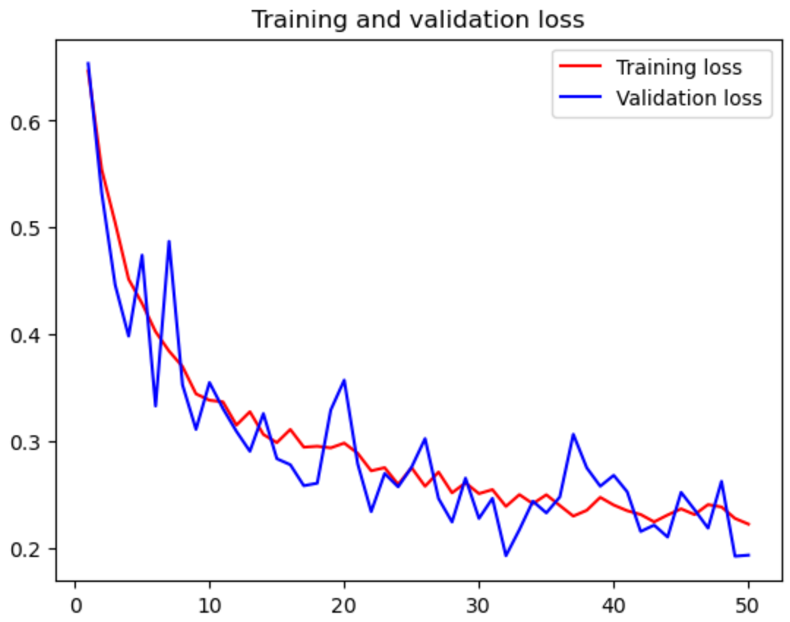
CNN sequential model architecture



Training details

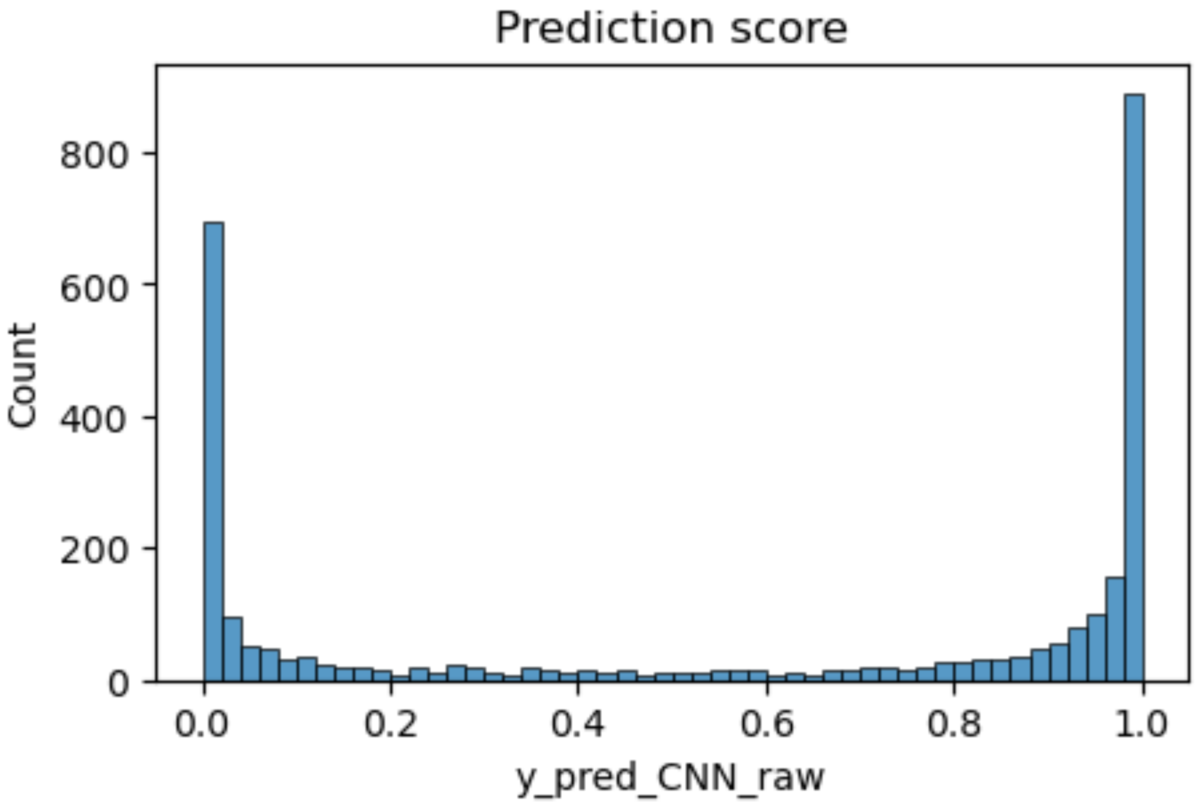
- 7779 files training + 884 validation
  - 4729 male eyes
  - 3914 female eyes
- 50 training passes through entire dateset (epochs)
  - images modified in each pass to simulate more data
    - Shift up to 10% u/d/l/r
    - Flip horizontal, vertical
    - Zoom up to 20%
    - Rotate up to +/-20°
    - Shear up to 20%
    - Target size 75x75 pixels
- 54 min training time (on desktop)



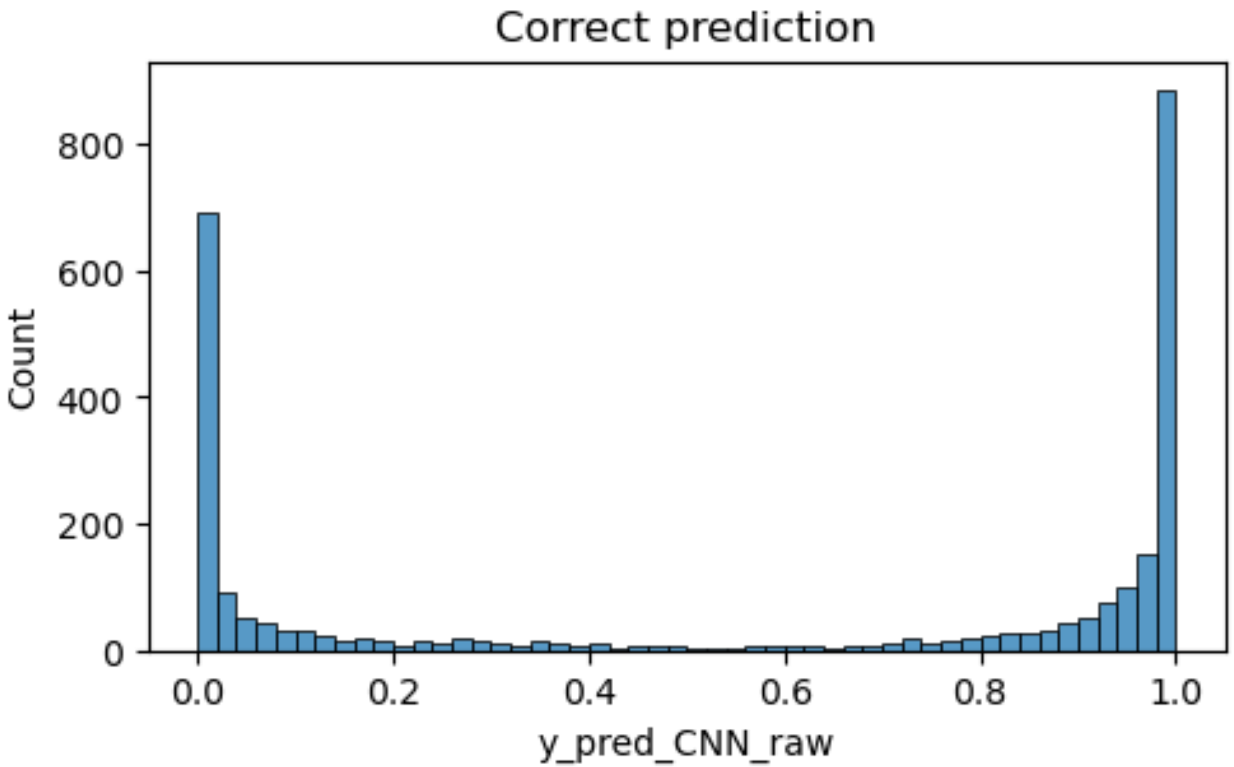


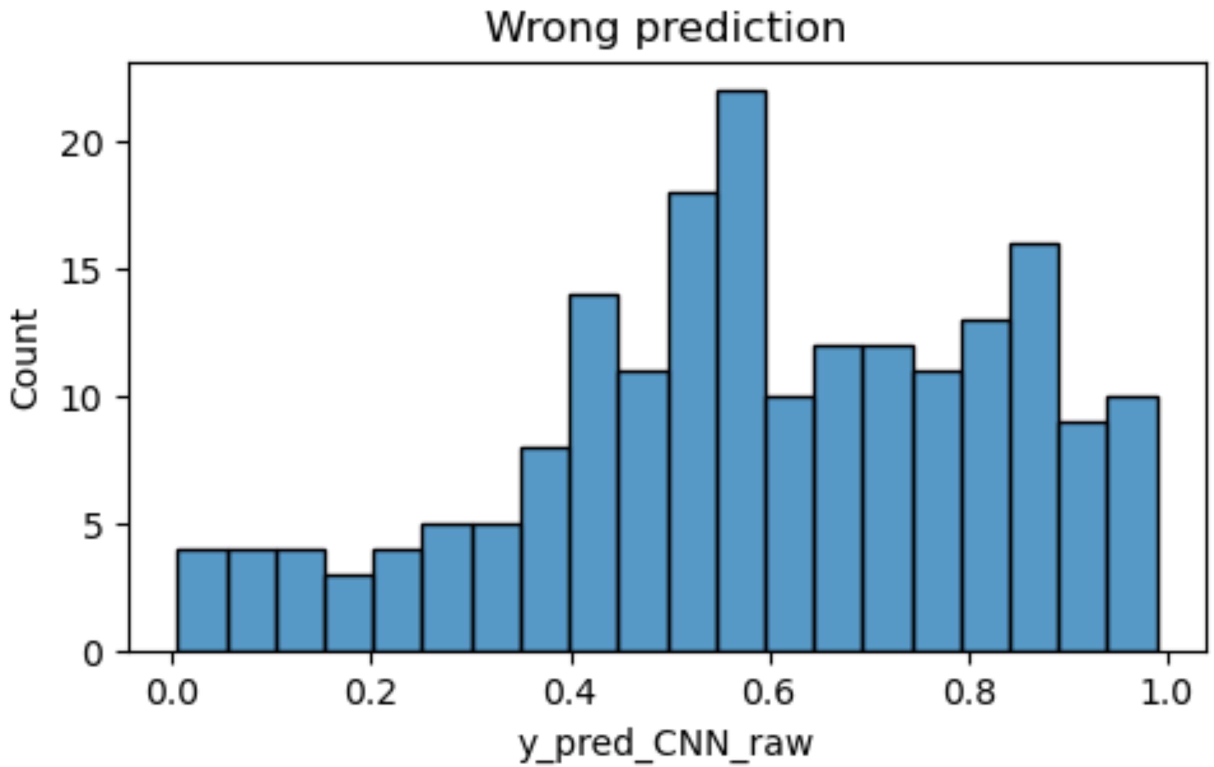
Test dataset predictions

- 2882 test images
- ~2.8ms/image to predict
- Y_pred_CNN_raw >=0.5 is "maleeyes"
- Y_pred_CNN_ra < 0.5 is "femaleeyes"
- Test accuracy 93%

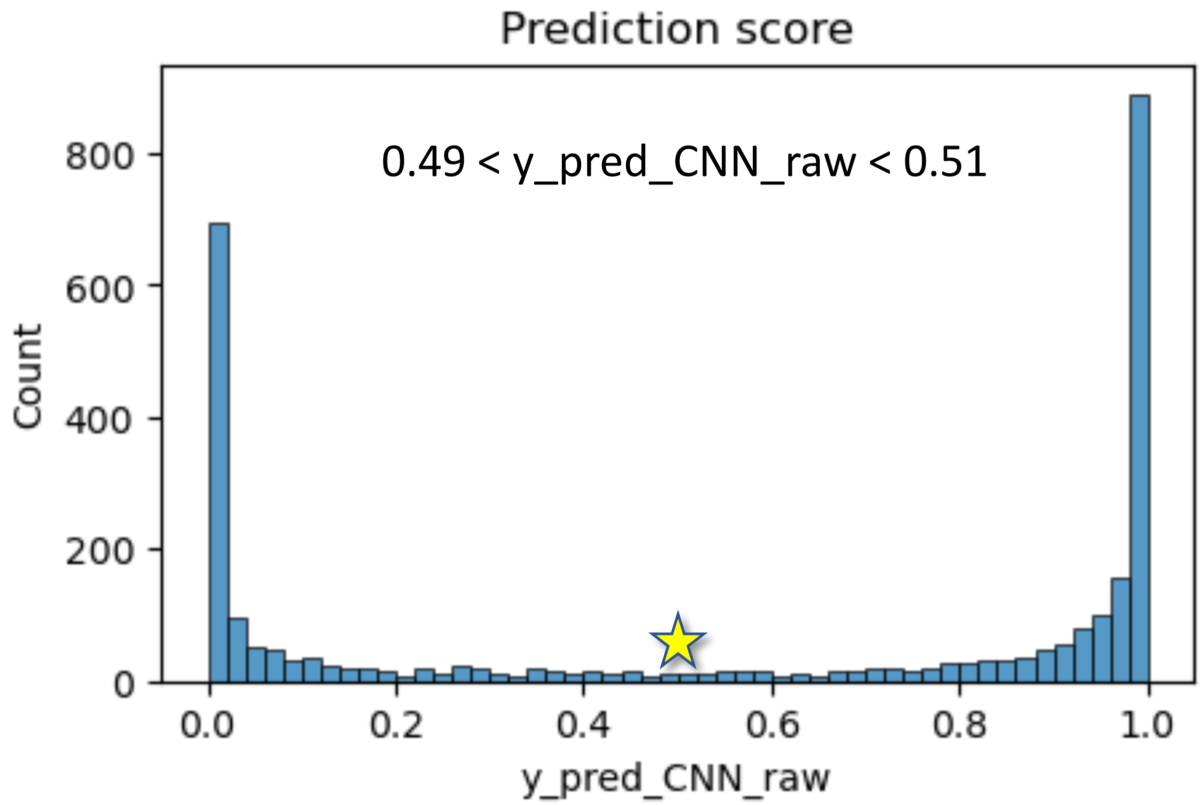


Distribution of correct, wrong predictions

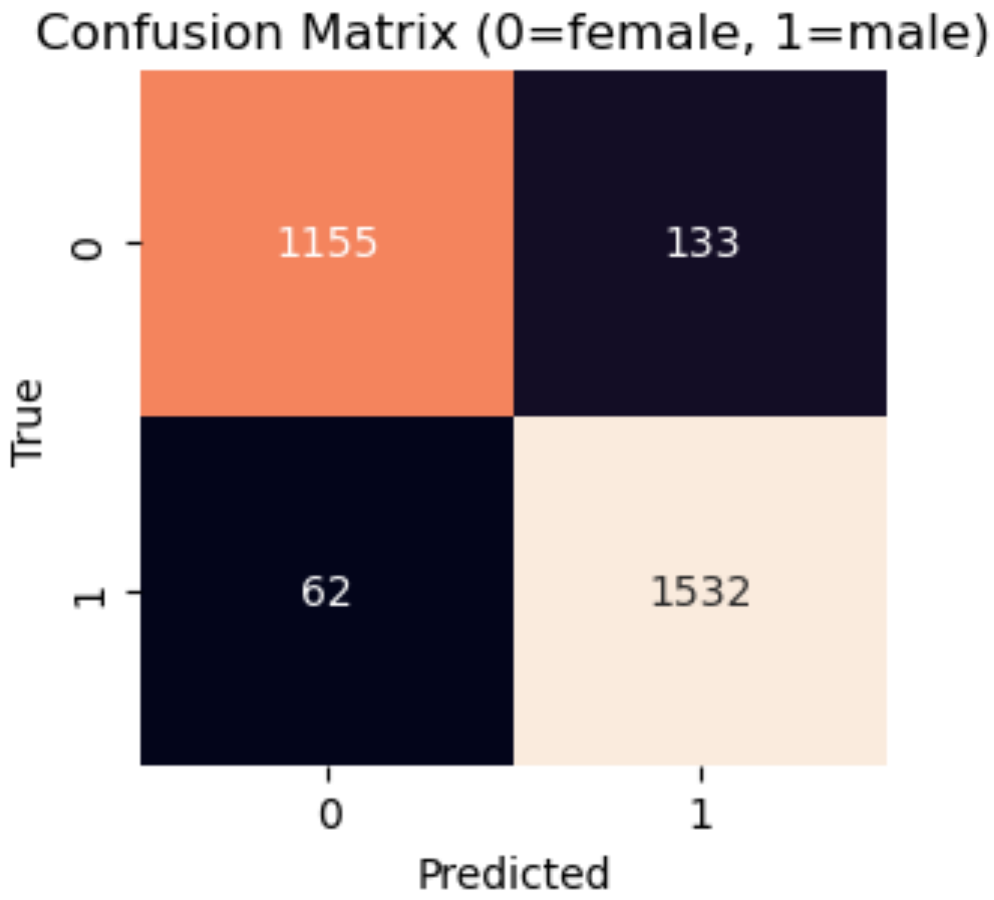


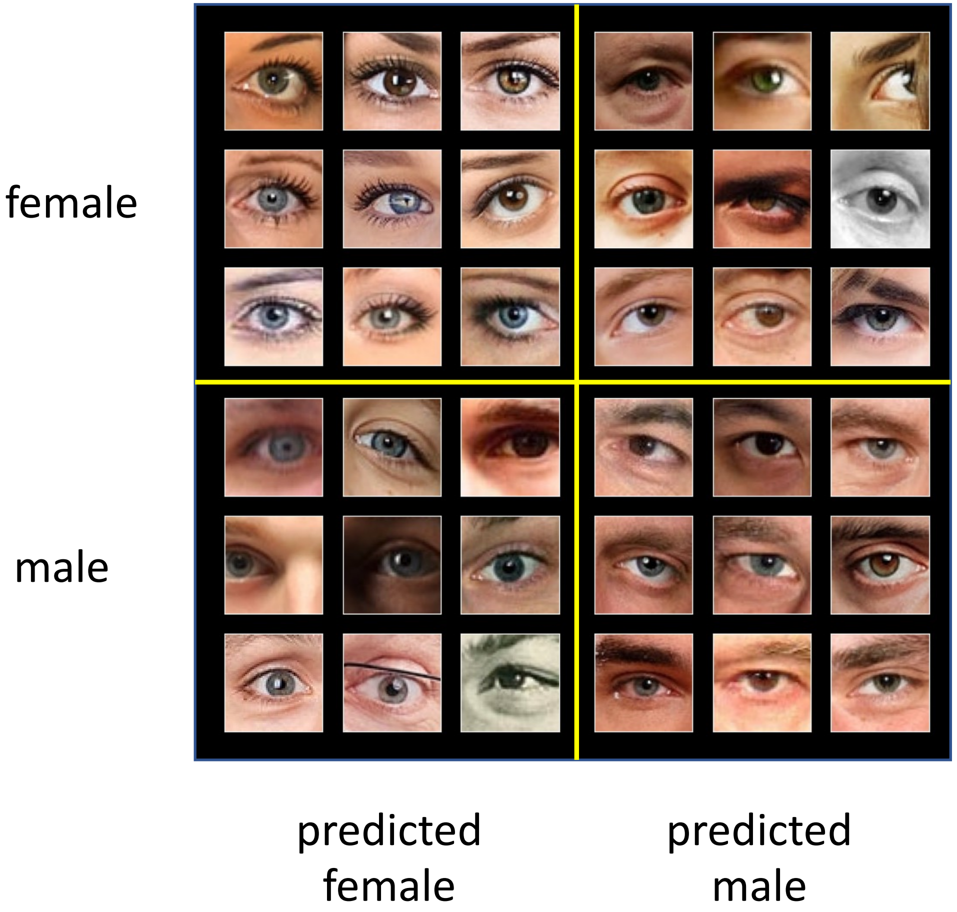


Lowest confidence predictions



Test set prediction matrix





Appendix

SpatialDropout layer

during training, mask out random 20% of input “feature maps” (is this 20% of the 64 input slices, and a different 20% for each what (image?, batch?, epoch?)

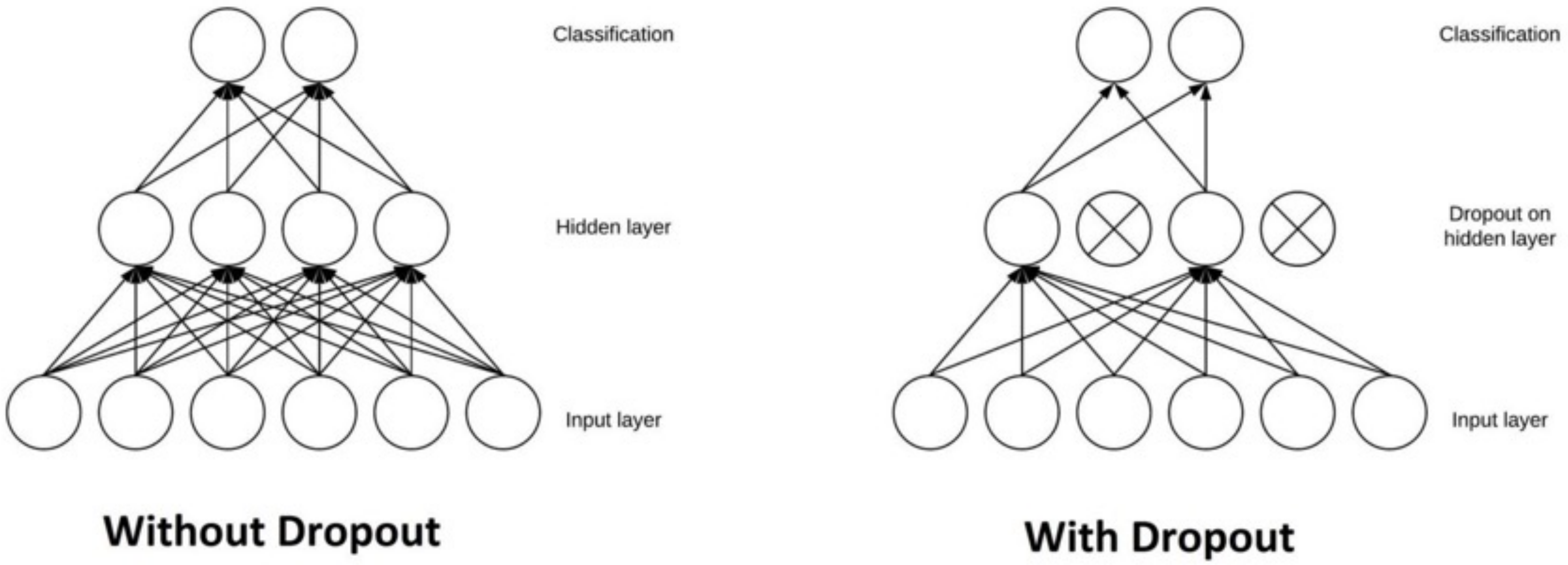
- https://keras.io/api/layers/regularization_layers/spatial_dropout2d/
  - Spatial 2D version of Dropout.
  - This version performs the same function as Dropout, however, it drops entire 2D feature maps instead of individual elements. If adjacent pixels within feature maps are strongly correlated (as is normally the case in early convolution layers) then regular dropout will not regularize the activations and will otherwise just result in an effective learning rate decrease. In this case, SpatialDropout2D will help promote independence between feature maps and should be used instead.
- https://stackoverflow.com/questions/55231347/using-dropout-on-convolutional-layers-in-keras
  - Usually, dropout is used to regularize [later] dense layers which are very prone to overfit
- https://machinelearningmastery.com/dropout-for-regularizing-deep-neural-networks/
  - Dropout is a regularization method that approximates training a large number of neural networks with different architectures in parallel.
  - During training, some number of layer outputs are randomly ignored or “dropped out.” This has the effect of making the layer look-like and be treated-like a layer with a different number of nodes and connectivity to the prior layer. In effect, each update to a layer during training is performed with a different “view” of the configured layer.
  - Dropout is not used after training when making a prediction with the fit network.

- https://www.baeldung.com/cs/ml-relu-dropout-layers

4. The Dropout Layer

Another typical characteristic of CNNs is a Dropout layer. **The Dropout layer is a mask that nullifies the contribution of some neurons towards the next layer and leaves unmodified all others**. We can apply a Dropout layer to the input vector, in which case it nullifies some of its features; but we can also apply it to a hidden layer, in which case it nullifies some hidden neurons.

Dropout layers are important in training CNNs because they prevent overfitting on the training data. If they aren't present, the first batch of training samples influences the learning in a disproportionately high manner. This, in turn, would prevent the learning of features that appear only in later samples or batches:



Say we show ten pictures of a circle, in succession, to a CNN during training. The CNN won't learn that straight lines exist; as a consequence, it'll be pretty confused if we later show it a picture of a square. We can prevent these cases by adding Dropout layers to the network's architecture, in order to prevent overfitting.