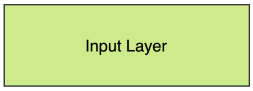
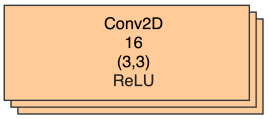
Artificial Neural Network Architectures

The following architectures are all based on the concept of a convolutional-recurrent neural network. Simplified, an image is given as input; a feature map is created by one or more convolutional layers; this feature map then provides the input to a recurrent layer, which divides the features map into 32 separate ‘stripes’, which in turn are each given a token of the class, i.e. a character of the alphabet.

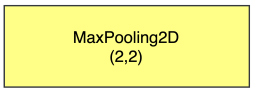
Legend



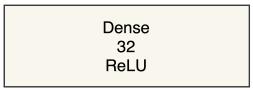
- takes an image of specified size as input



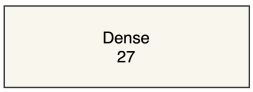
- convolutional layer with 16 output filters
- (3,3) sized convolution window
- ReLU activation



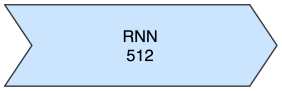
- MaxPooling layer with kernel size (2,2)



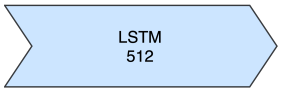
- neurone layer with 32 neurones
- ReLU activation



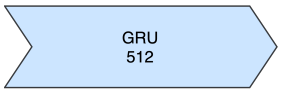
- neurone layer with 32 neurones



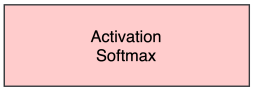
- recurrent layer with 512 cells



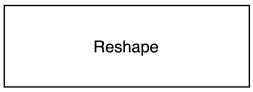
- Long Short-Term Memory layer with 512 cells



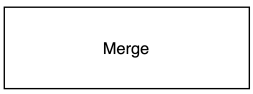
- Gated Recurrent Unit with 512 cells



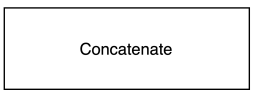
- Softmax Activation layer



- reshape layer, turns higher dimensional data into one dimensional data

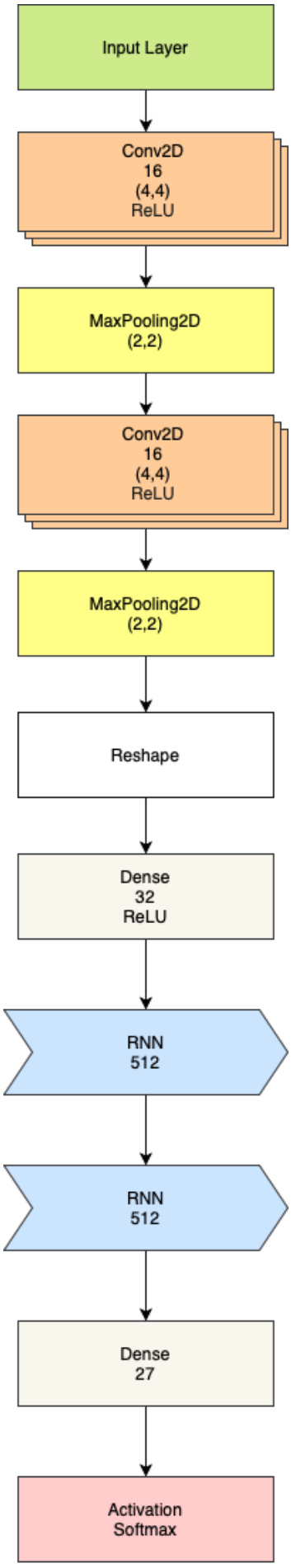


- merge layer, simply adds two inputs together

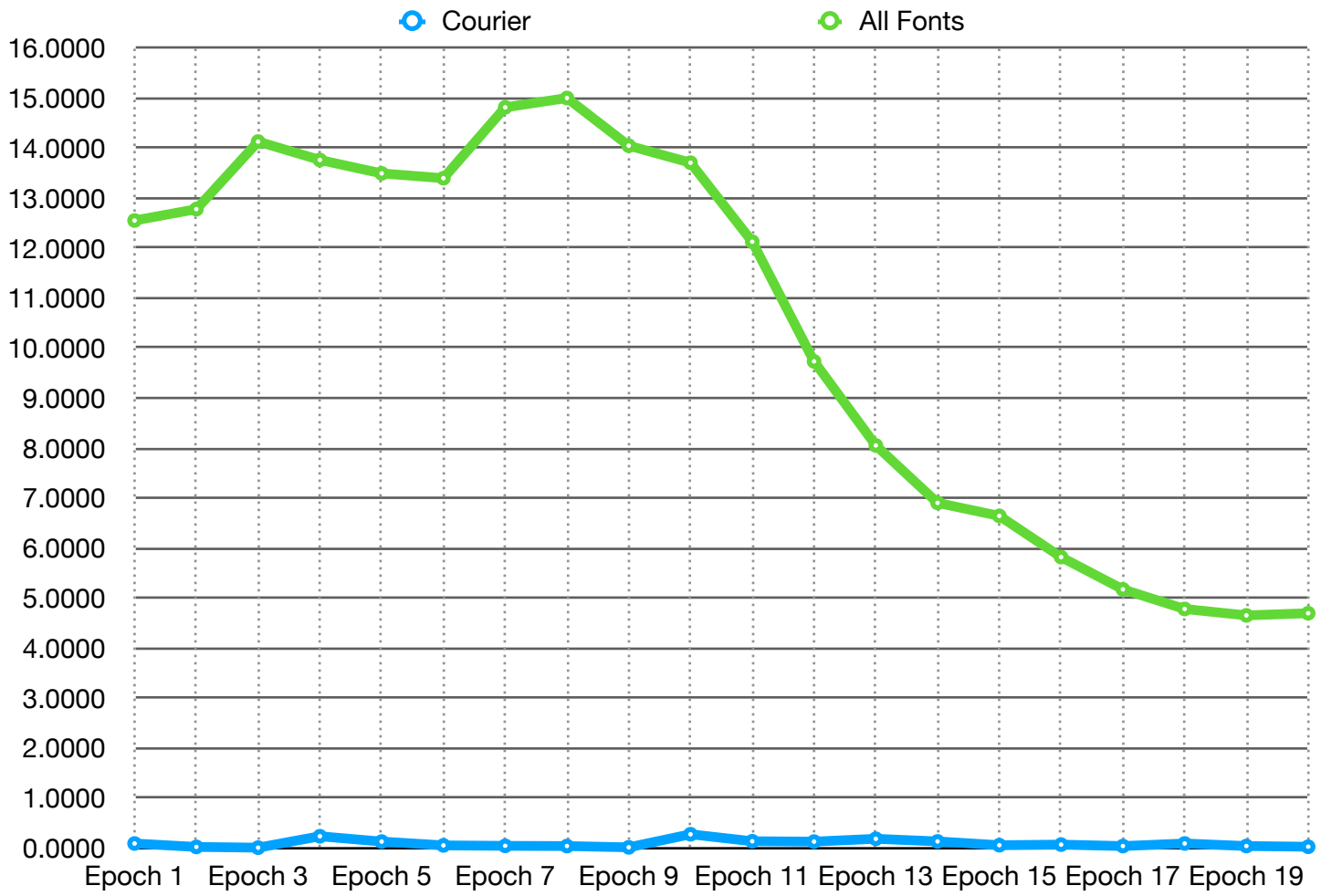


- concatenate layer, links two sequences together

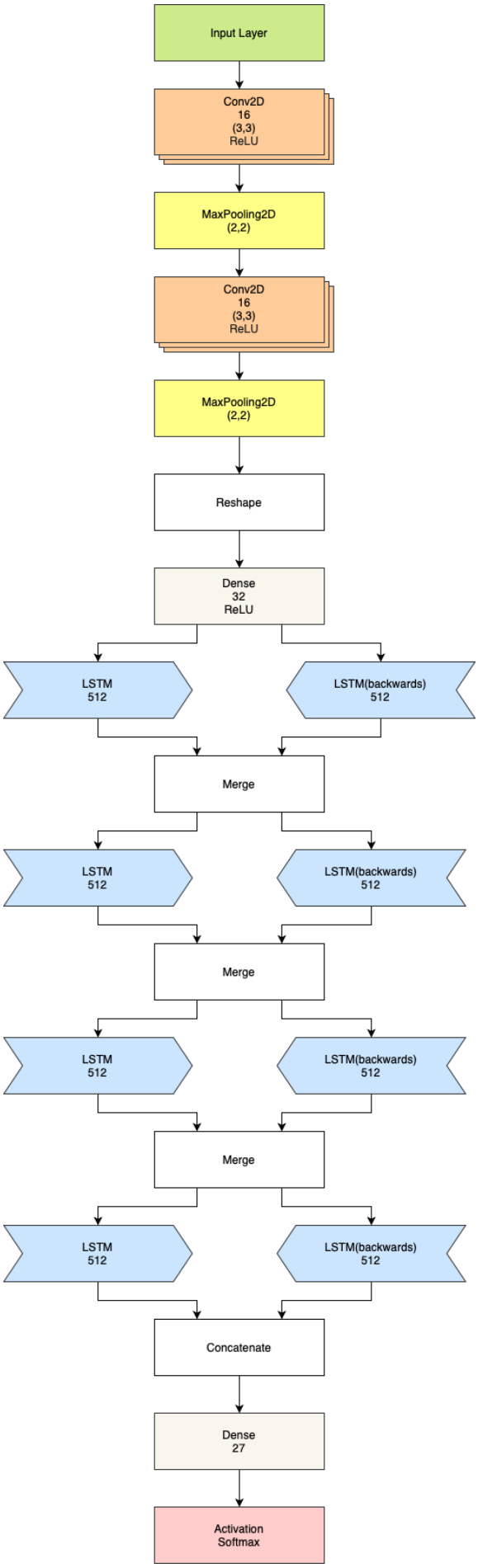
CNN RNN alternative



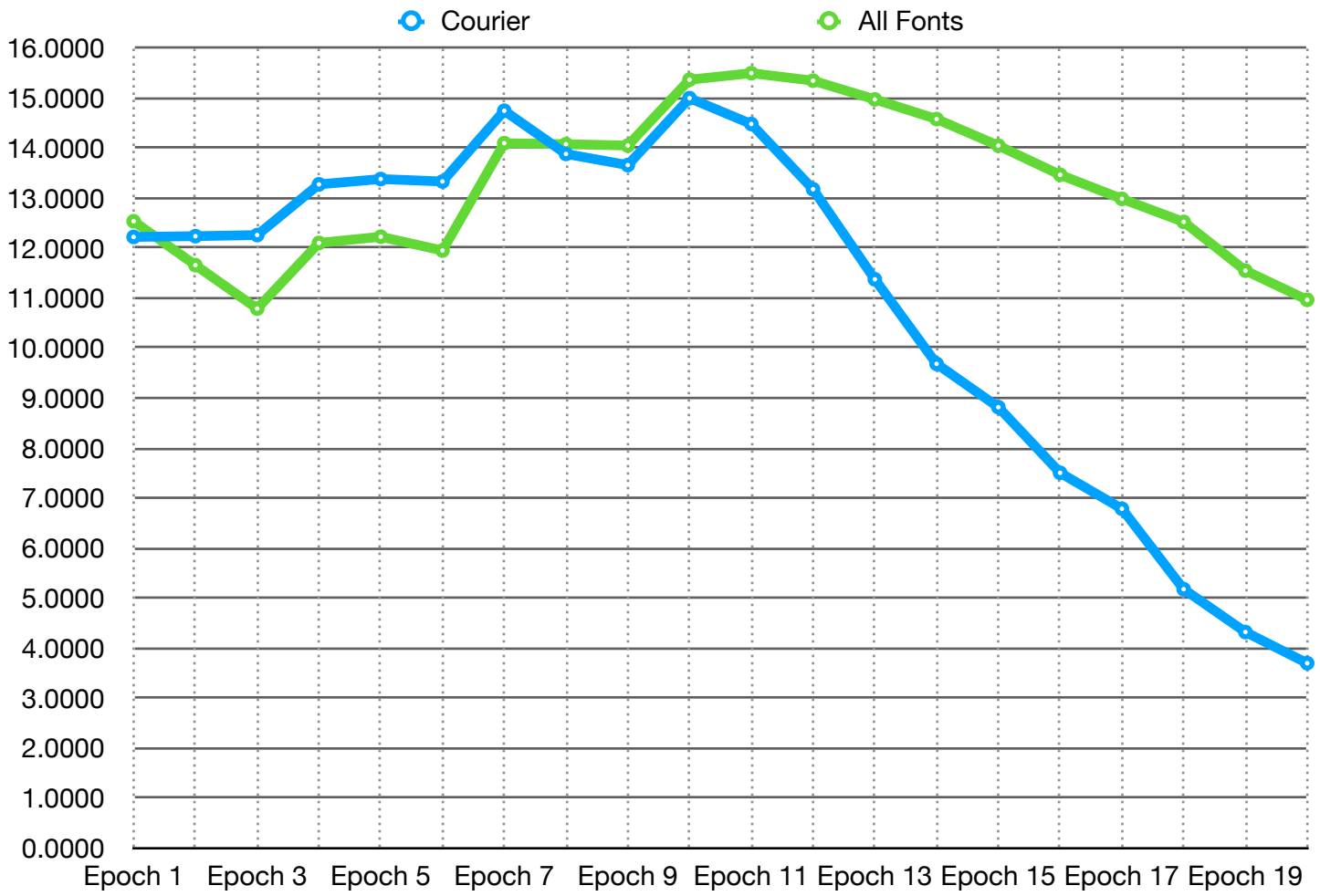
Model Performance



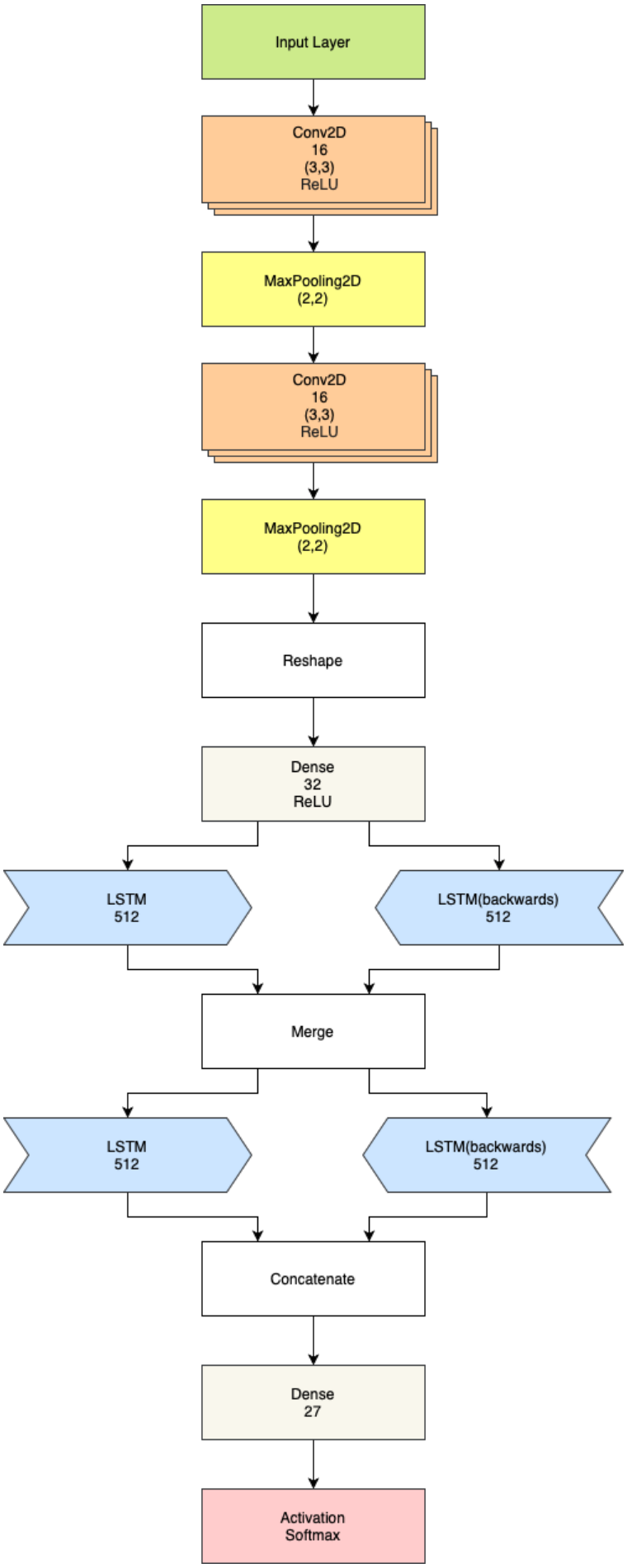
CNN LSTM double



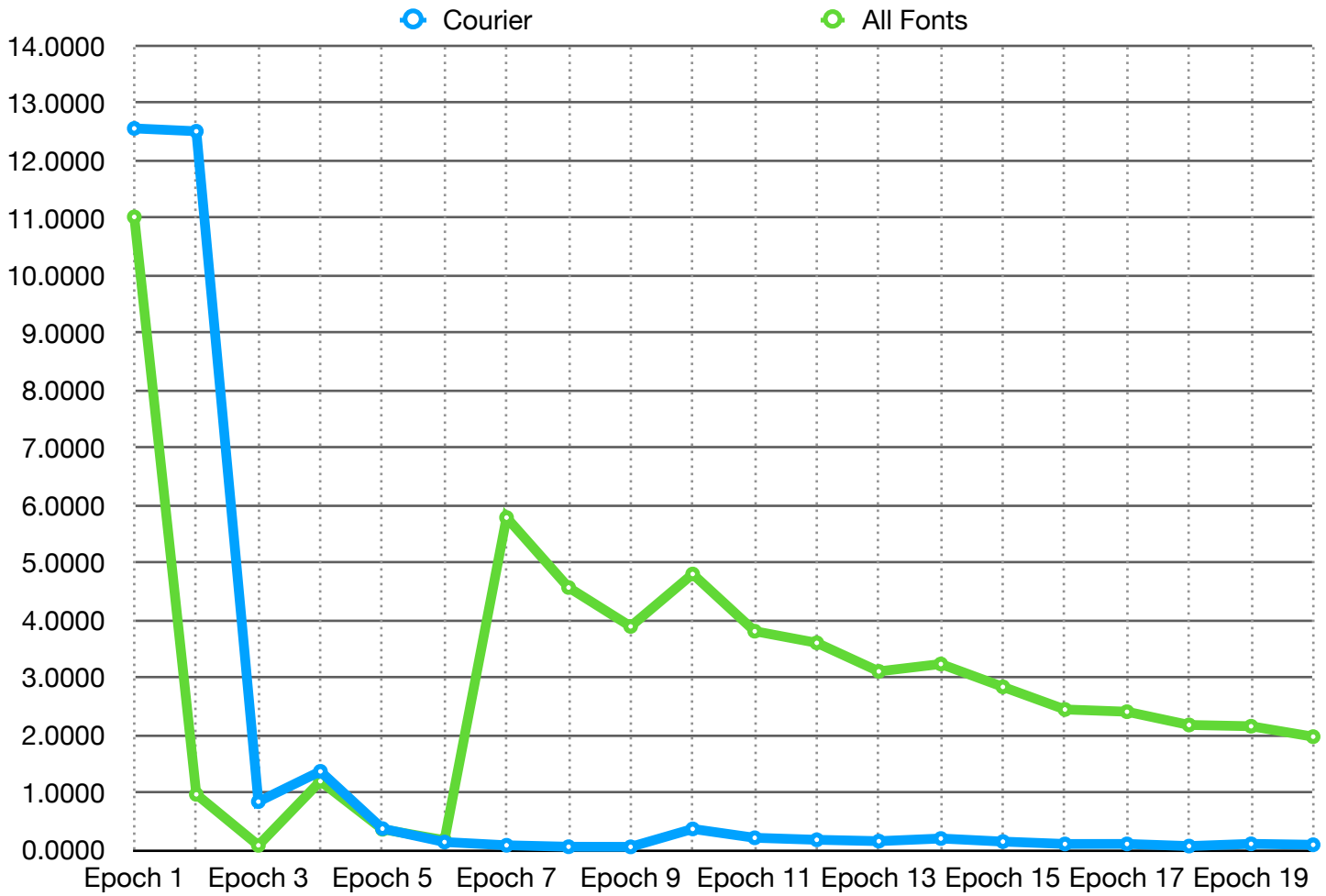
Model Performance



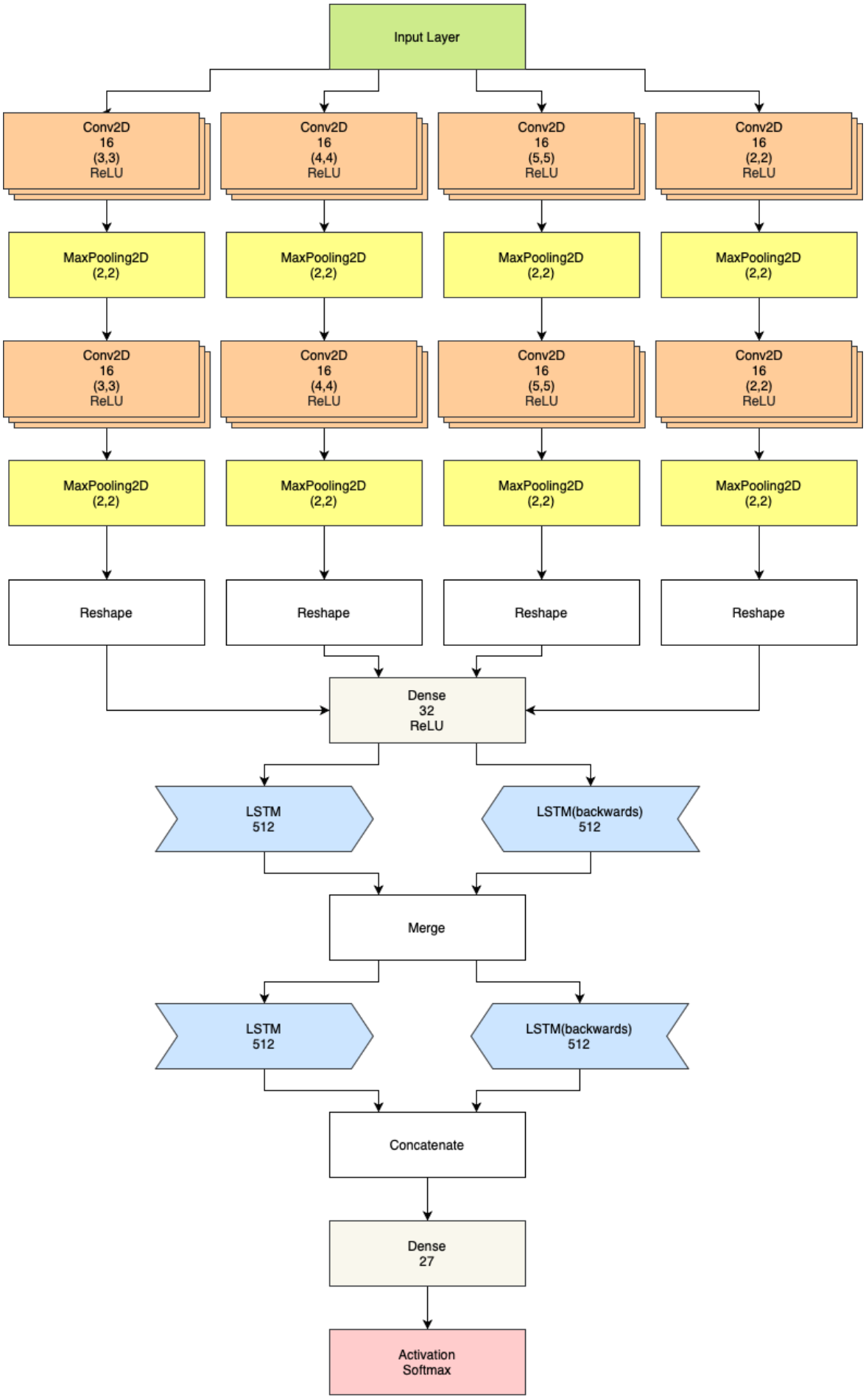
CNN LSTM


Input Layer
Conv2D
16
(3,3)
ReLU
MaxPooling2D
(2,2)
Conv2D
16
(3,3)
ReLU
MaxPooling2D
(2,2)
Reshape
Dense
32
ReLU
LSTM
512
LSTM(backwards)
512
Merge
LSTM
512
LSTM(backwards)
512
Concatenate
Dense
27
Activation
Softmax

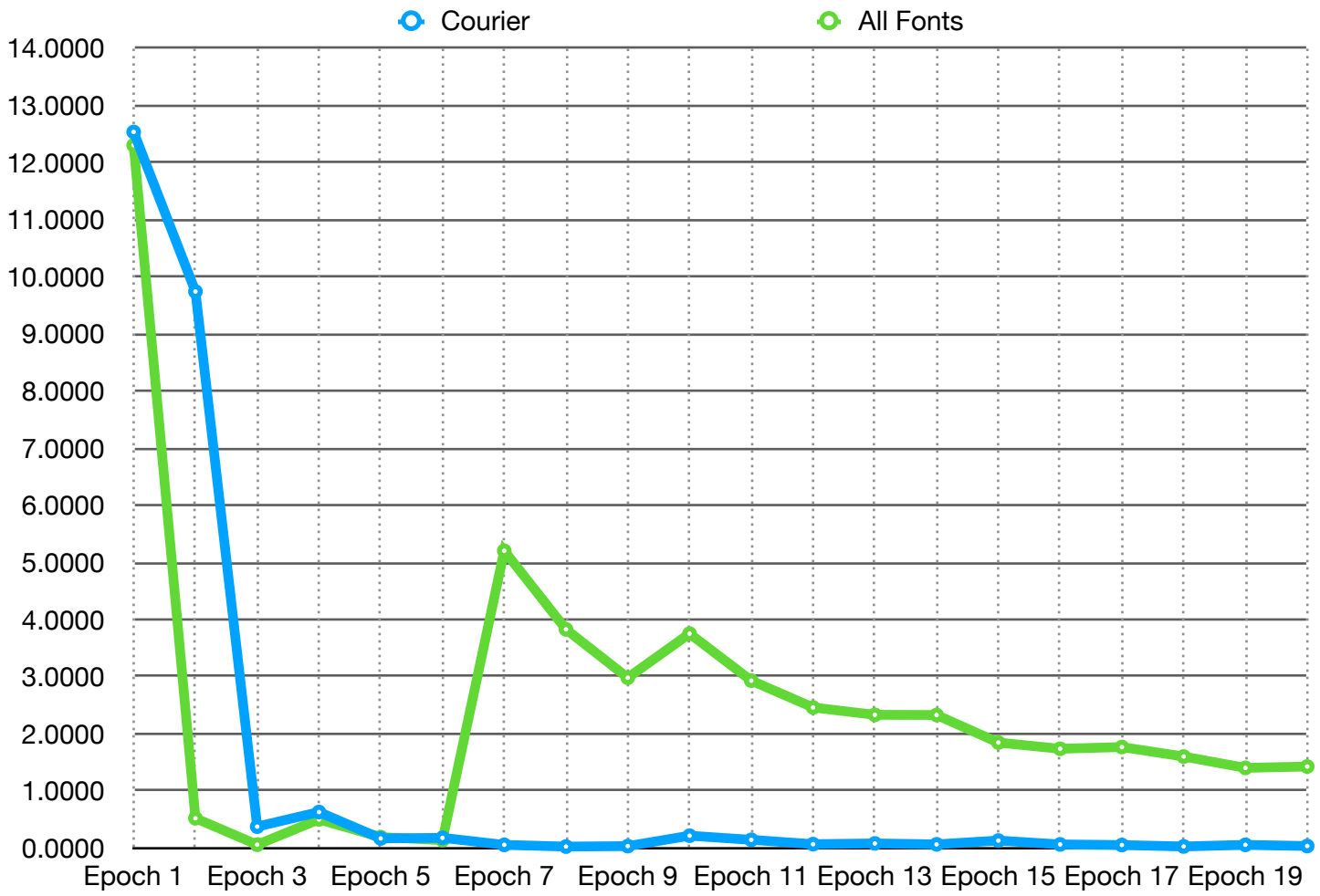
Model Performance



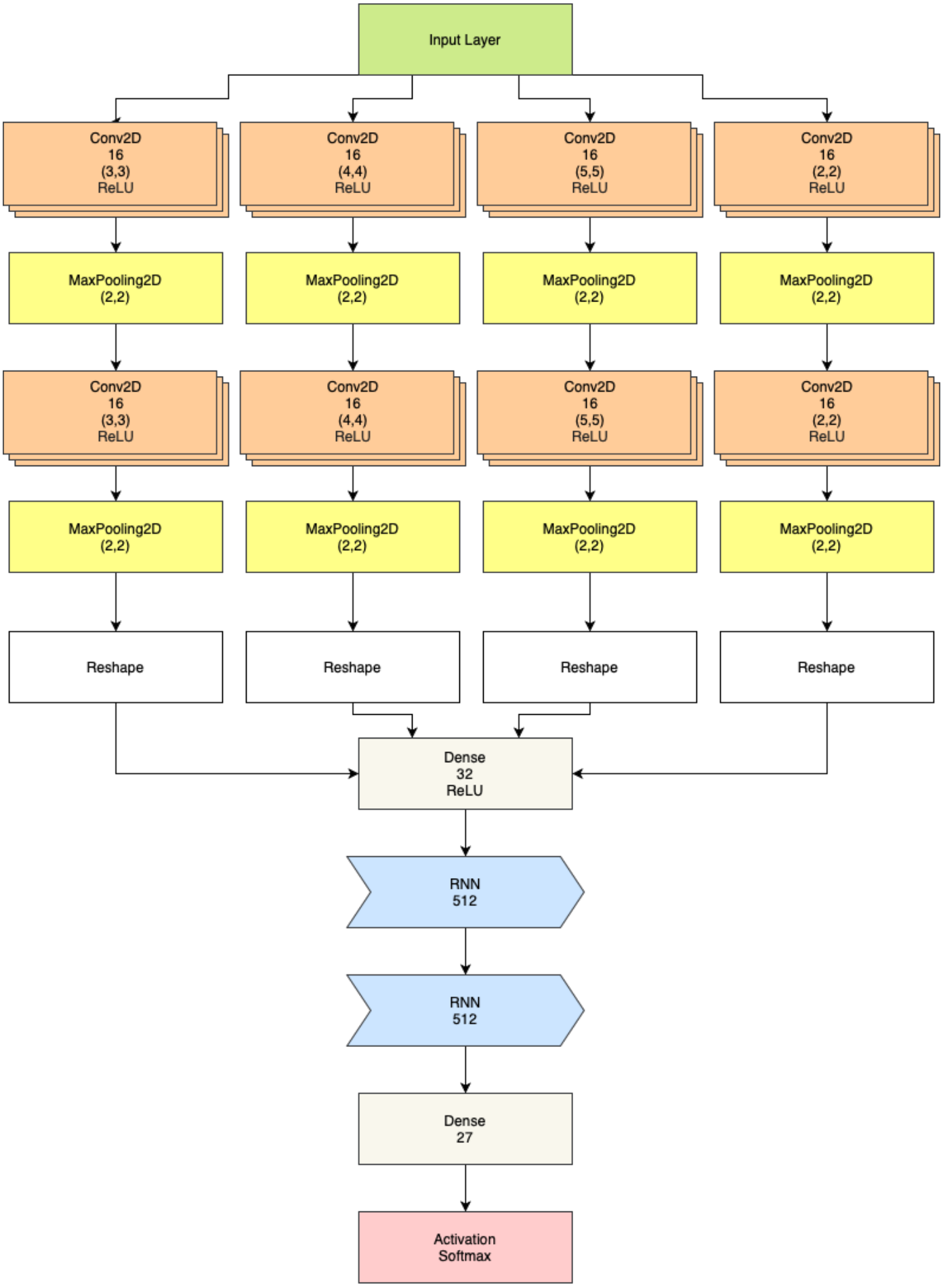
CNN parallel LSTM



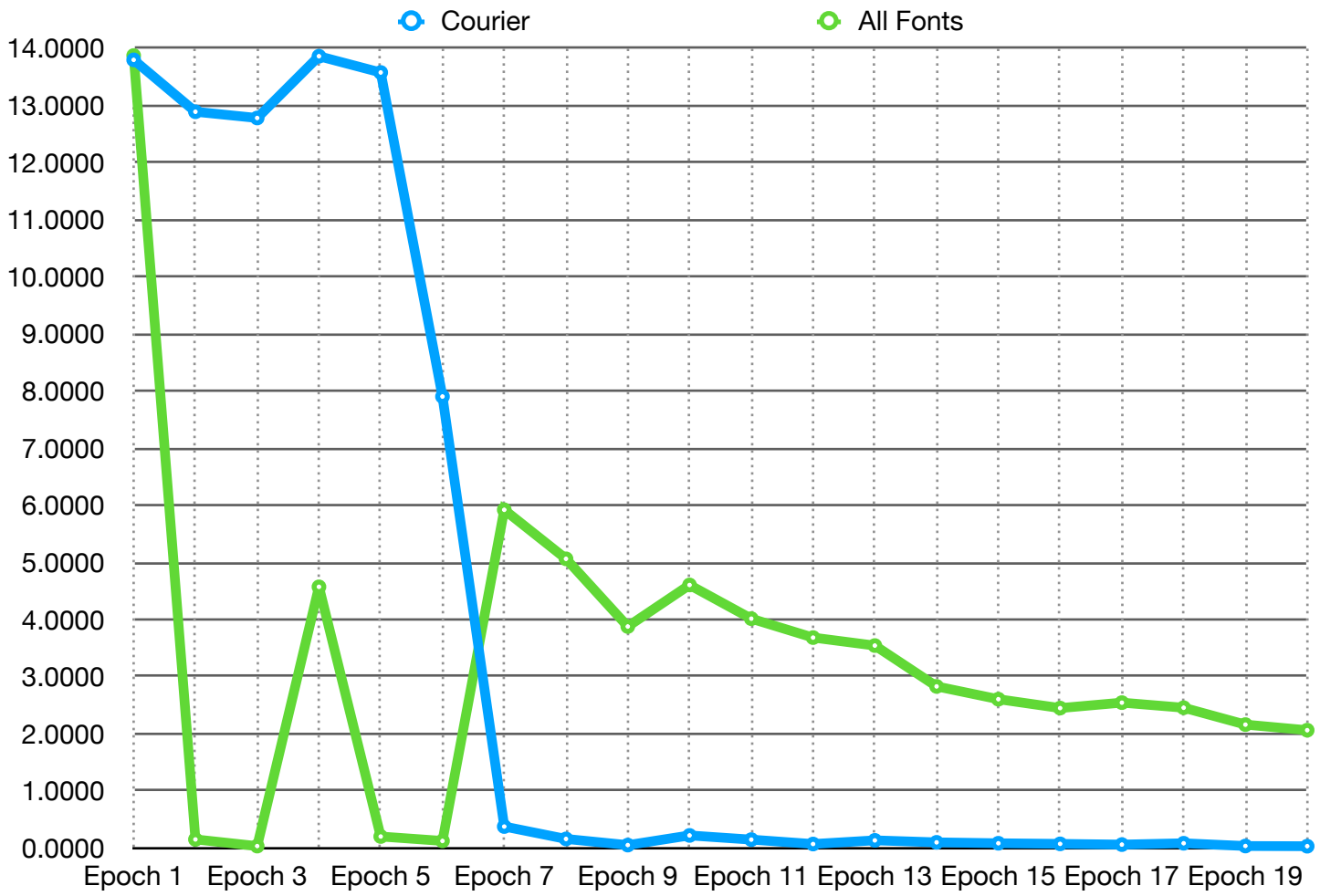
Model Performance



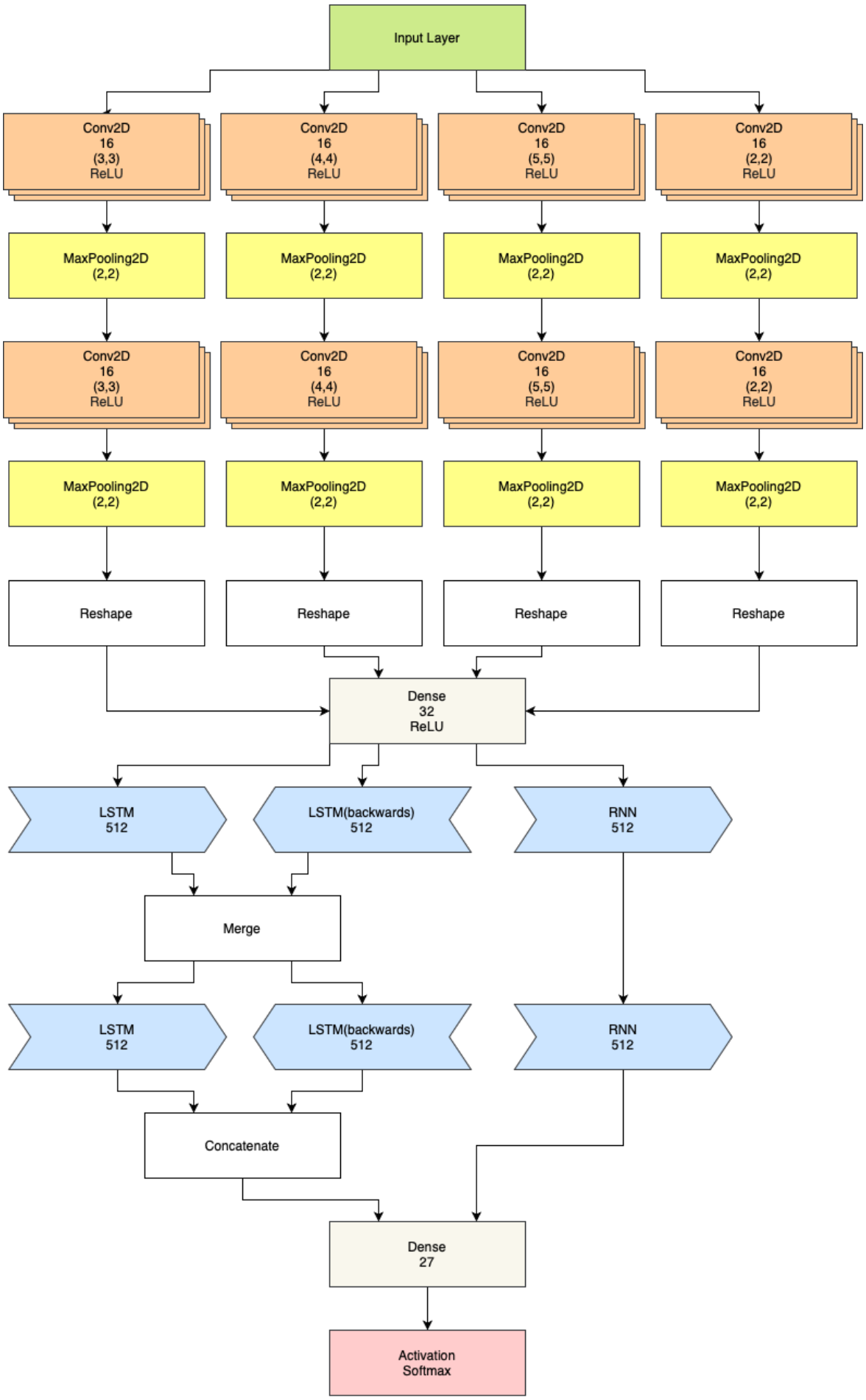
CNN parallel RNN



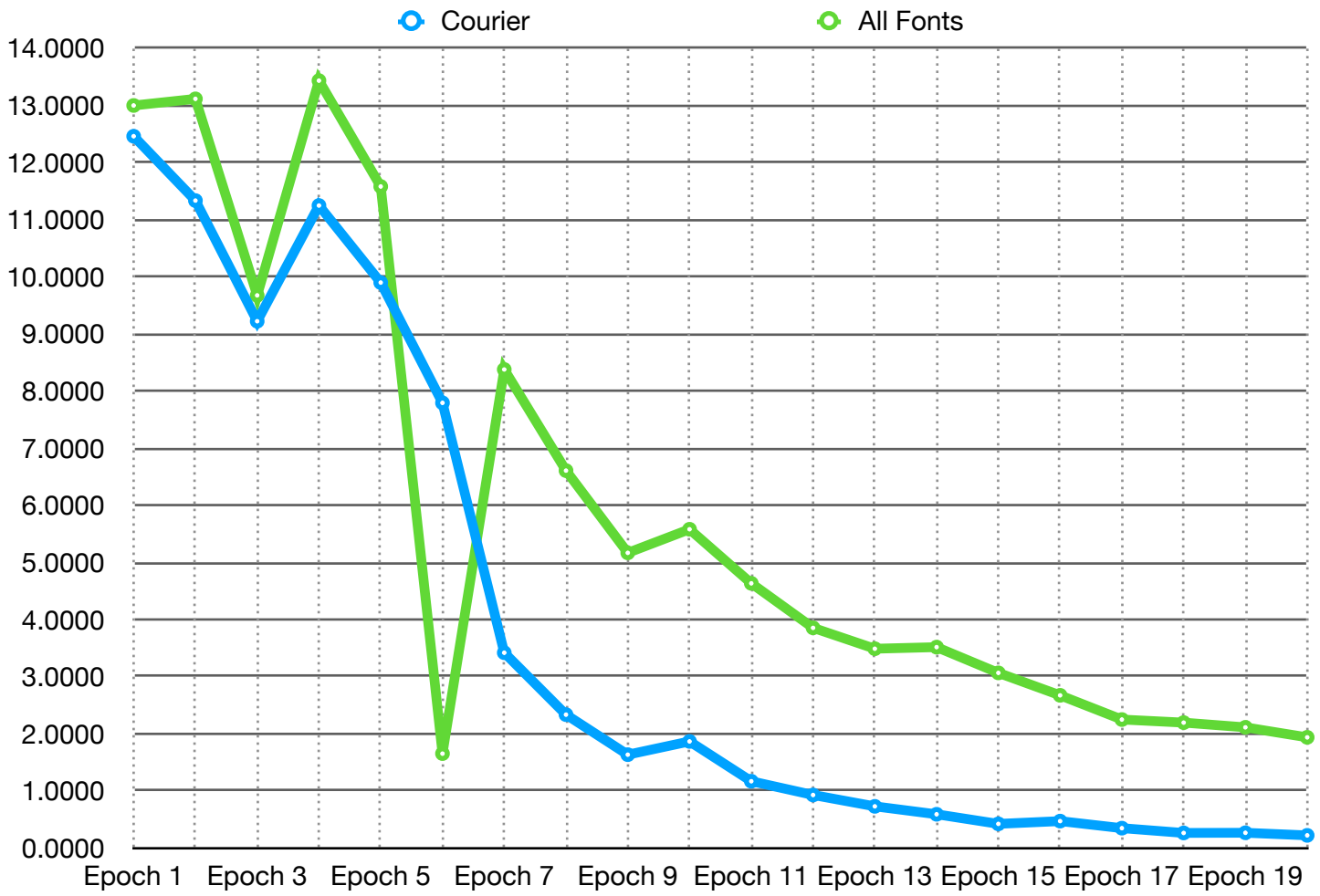
Model Performance



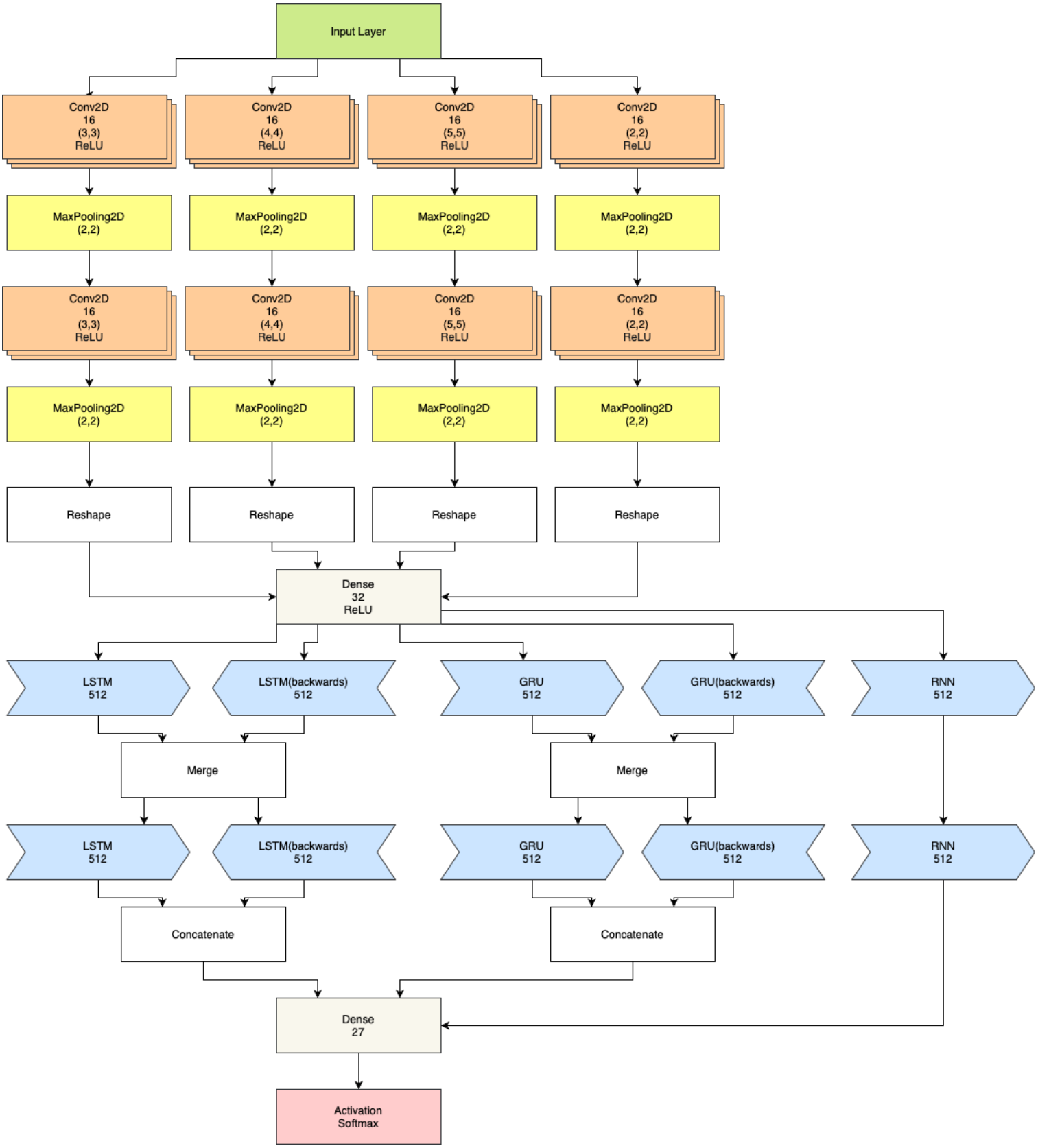
CNN parallel LSTM RNN



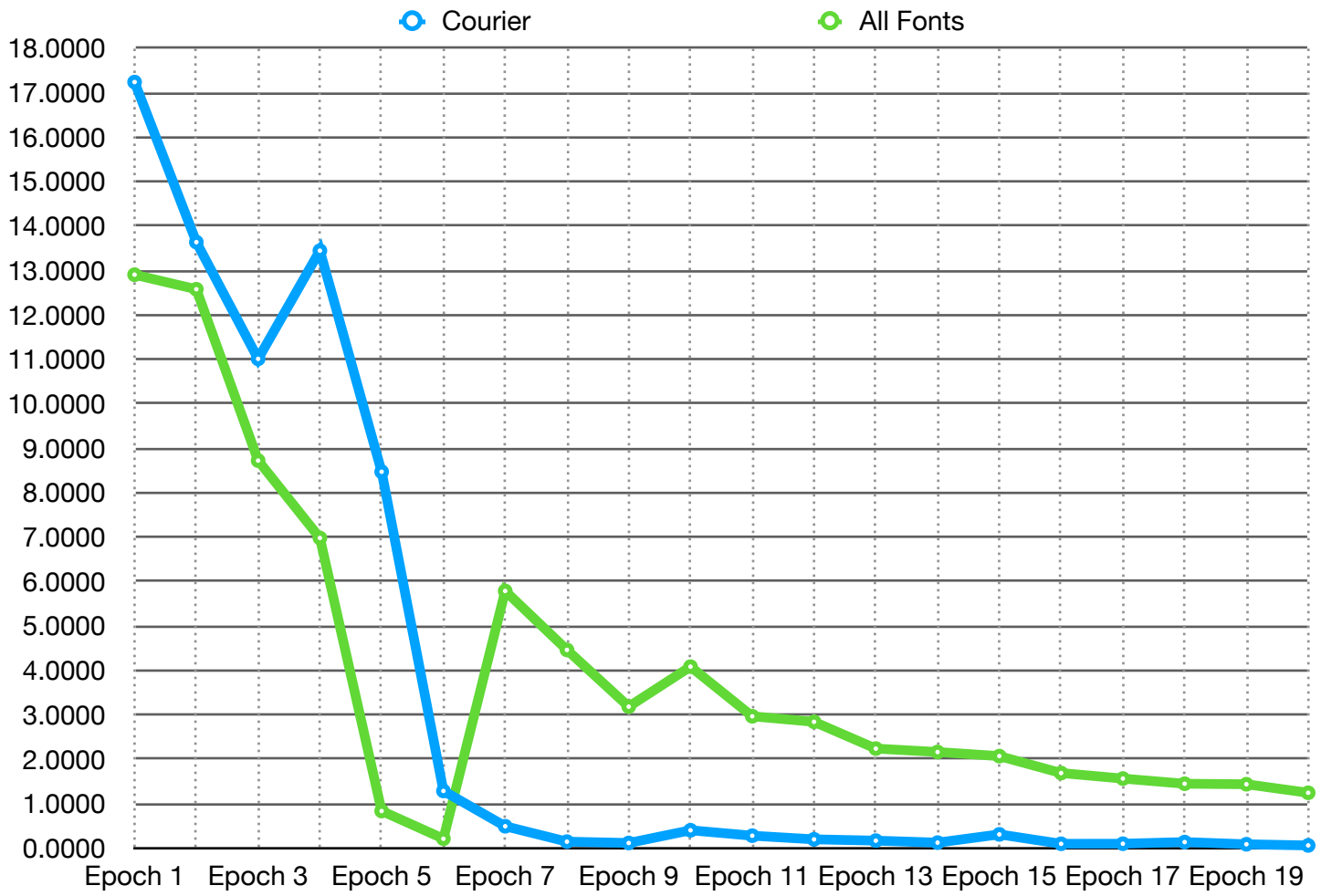
Model Performance



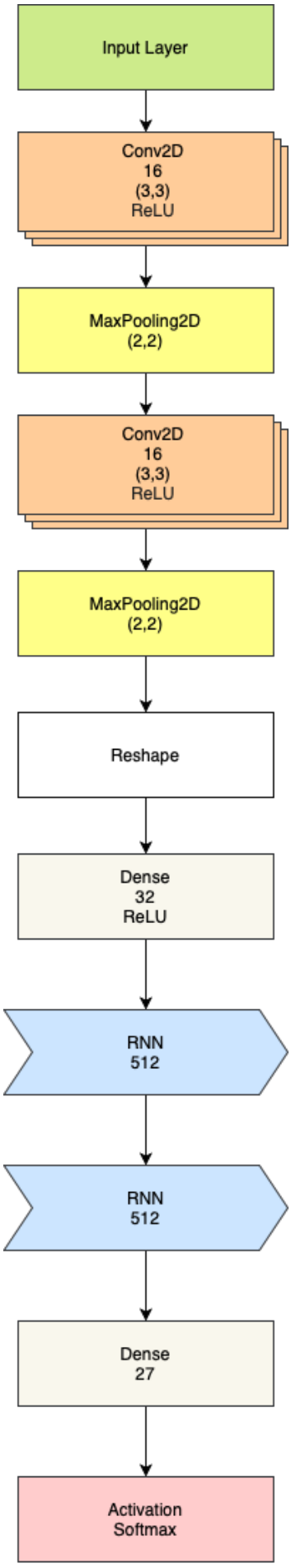
CNN parallel LSTM GRU RNN



Model Performance



CNN RNN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(3,3)
ReLU
MaxPooling2D
(2,2)
Conv2D
16
(3,3)
ReLU
MaxPooling2D
(2,2)
Reshape
Dense
32
ReLU
RNN
512
RNN
512
Dense
27
Activation
Softmax

Model Performance