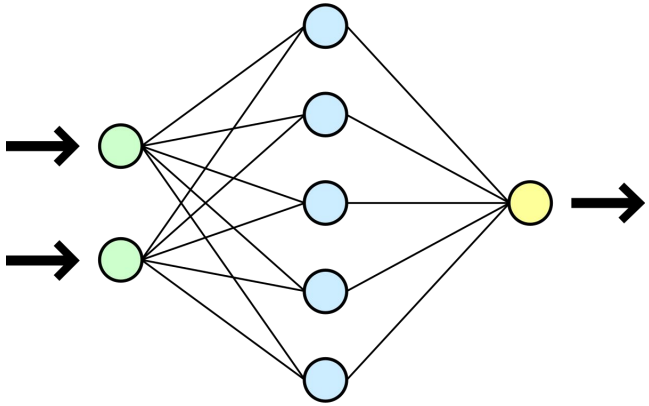

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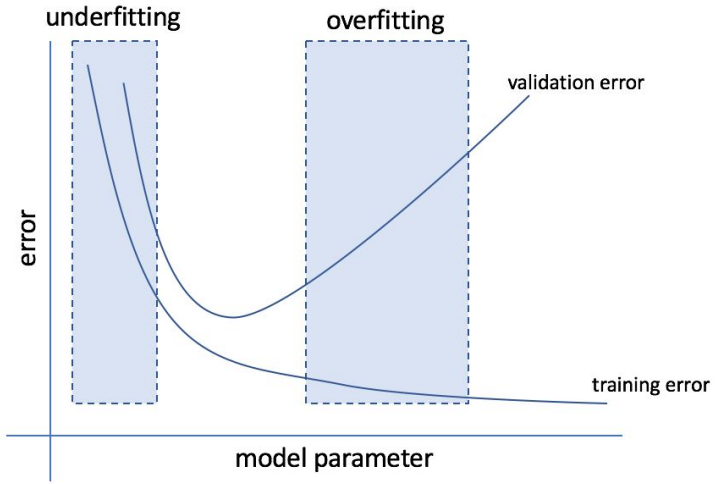
Neural Networks

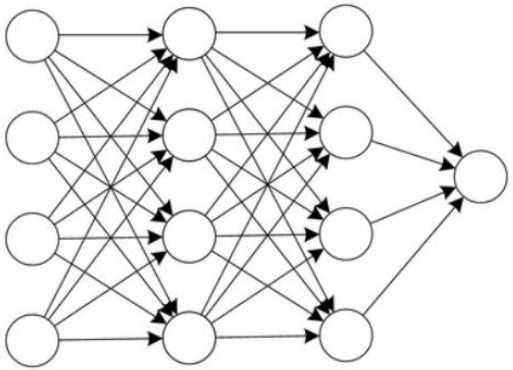
Regularization

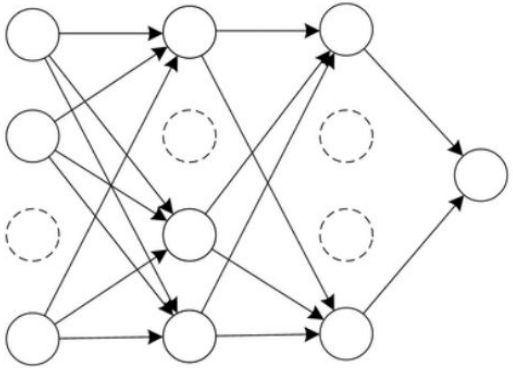
Recap - Last Video

- Overfitting and Underfitting in Neural Networks
- What causes it and how to reduce it?



Regularization





Regularizers - L1 and L2

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- L1

$$Loss = Error(y, \hat{y}) + \lambda \sum_{i=1}^{N} |w_i|$$

- L2

$$Loss = Error(y, \hat{y}) + \lambda \sum_{i=1}^{N} w_i^2$$

- The main difference is that L1 tries to estimate the median of the data, while L2 tries to estimate the mean of the data to avoid overfitting

- They can be used together

Regularization in Keras

- `kernel_regularizer`: Regularizer to apply a penalty on the layer's kernel
- `bias_regularizer`: Regularizer to apply a penalty on the layer's bias
- `activity_regularizer`: Regularizer to apply a penalty on the layer's output

```
from tensorflow.keras import layers
from tensorflow.keras import regularizers

layer = layers.Dense(
    units=64,
    kernel_regularizer=regularizers.l1_l2(l1=1e-5, l2=1e-4),
    bias_regularizer=regularizers.l2(1e-4),
    activity_regularizer=regularizers.l2(1e-5)
)
```