

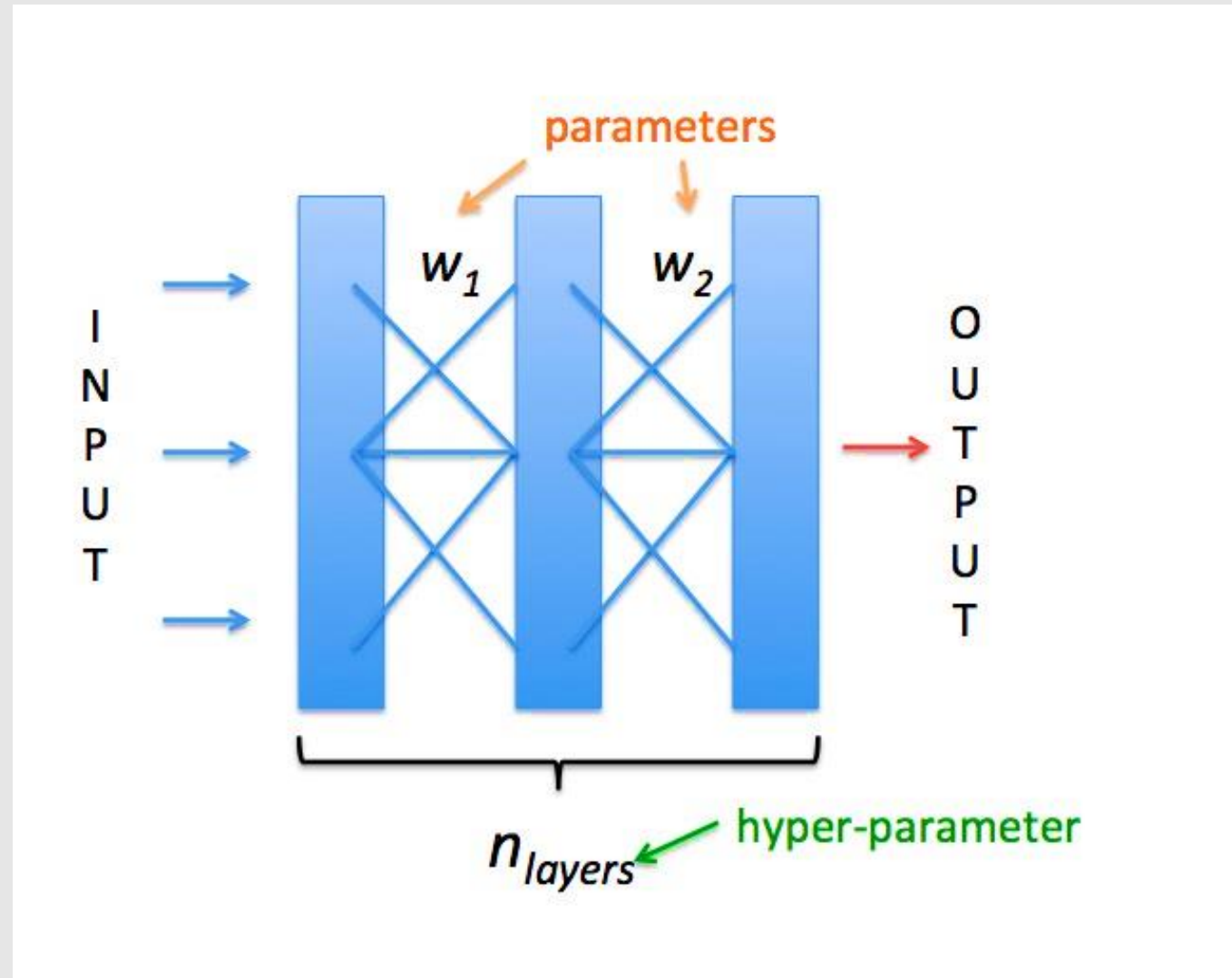
# Getting Started with ML and Deep Learning Frameworks

Fatos Ismali

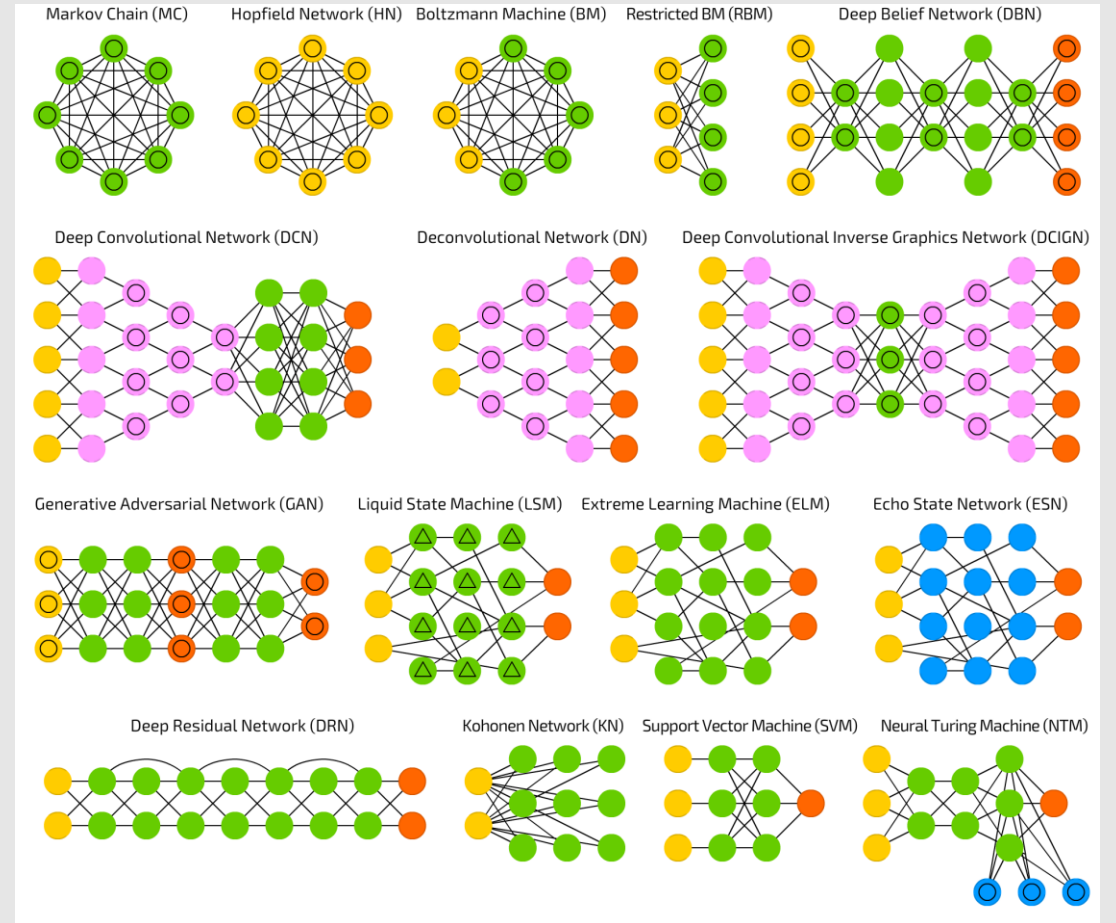
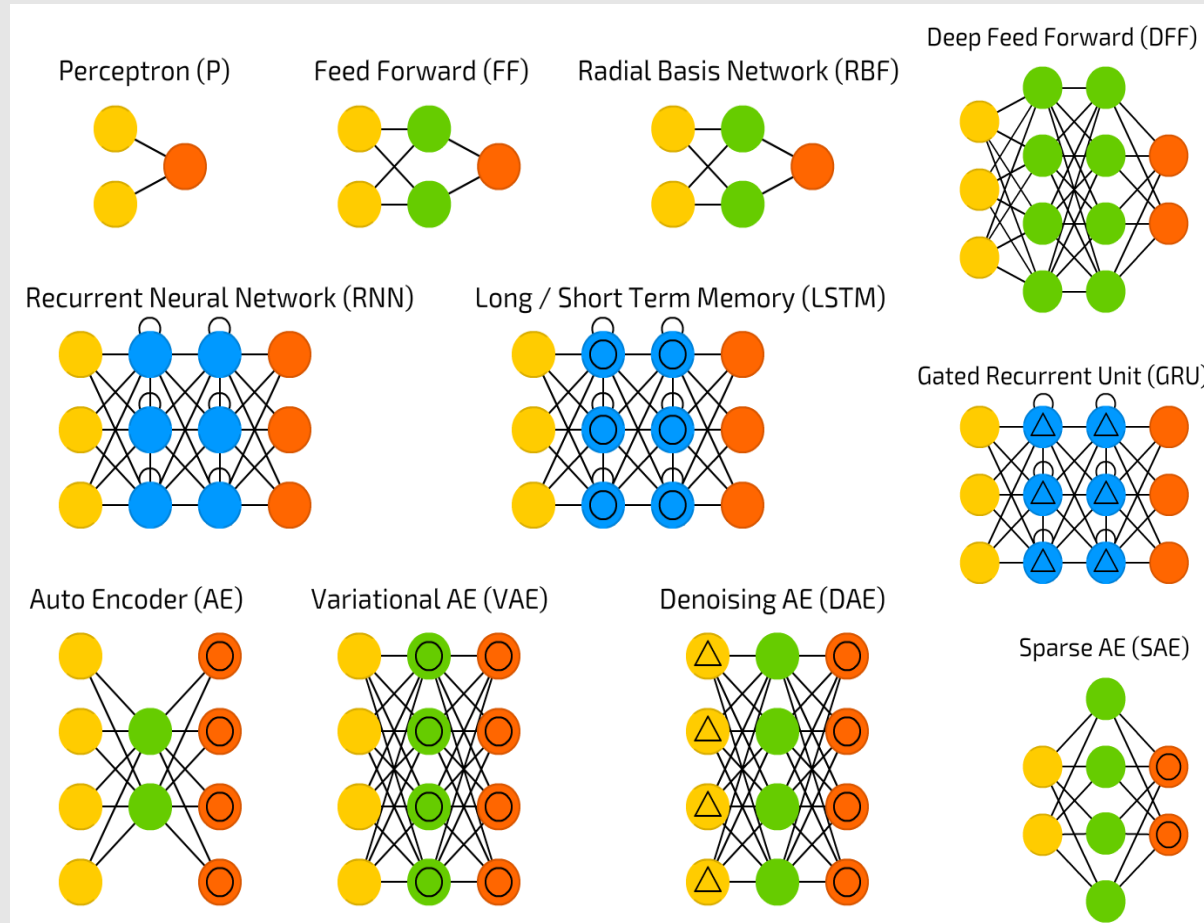
# Agenda

- Brief overview of Neural Networks
- Getting hands-on with PyTorch
- Getting hands-on with Keras and Tensorflow

# What is a Neural Network?

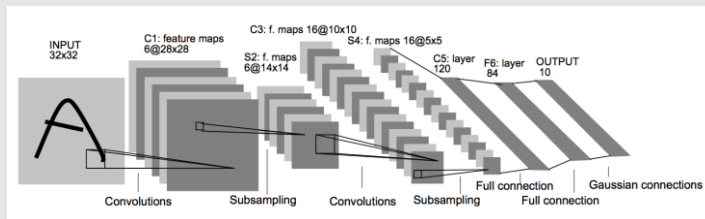


# Variants of Neural Networks

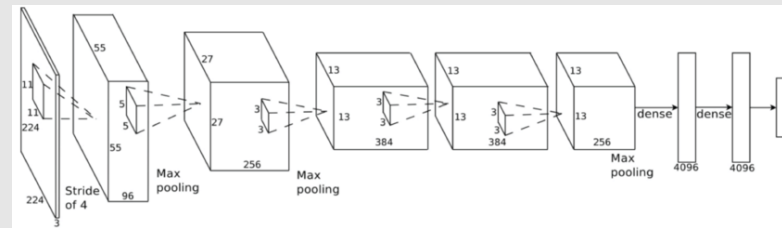


# Common Architectures in Convolutional NNs

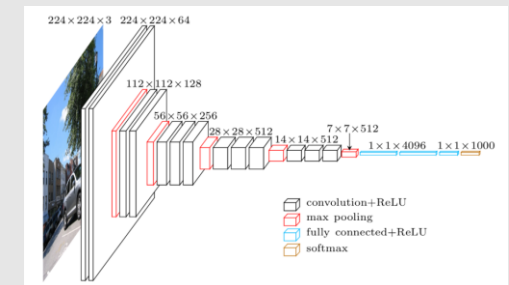
# LeNET-5



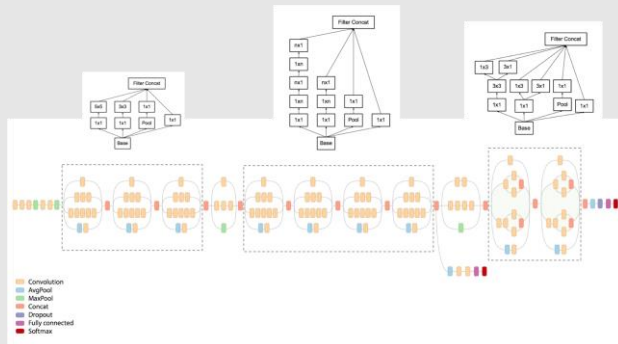
# AlexNet



# VGG-16



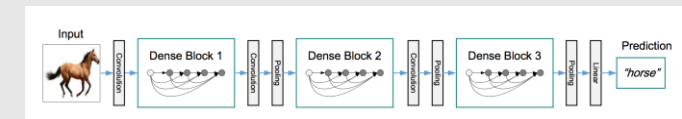
# Inception (GoogLeNet)



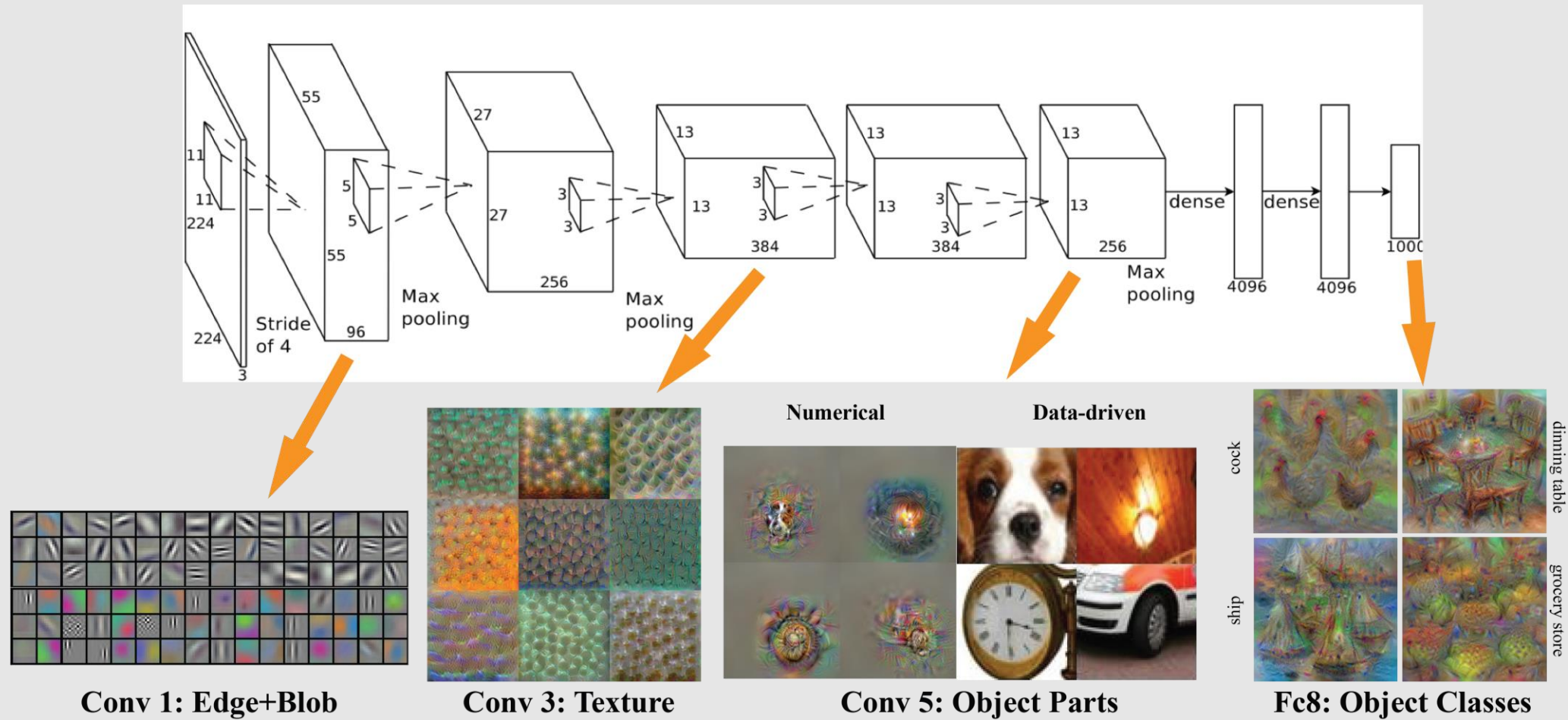
# ResNet



## DenseNet



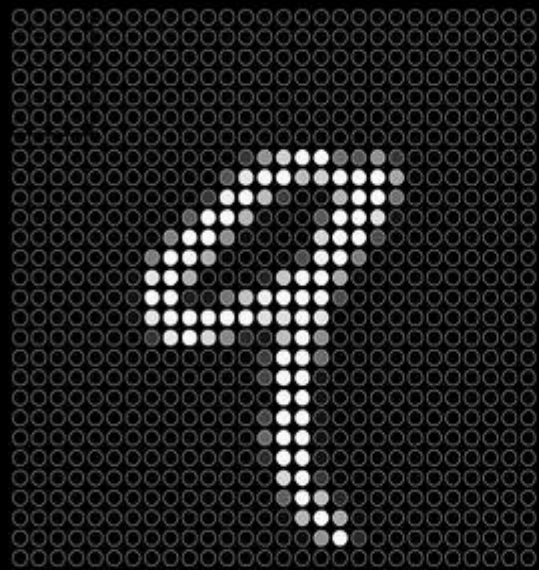
# Different layers different semantic representation



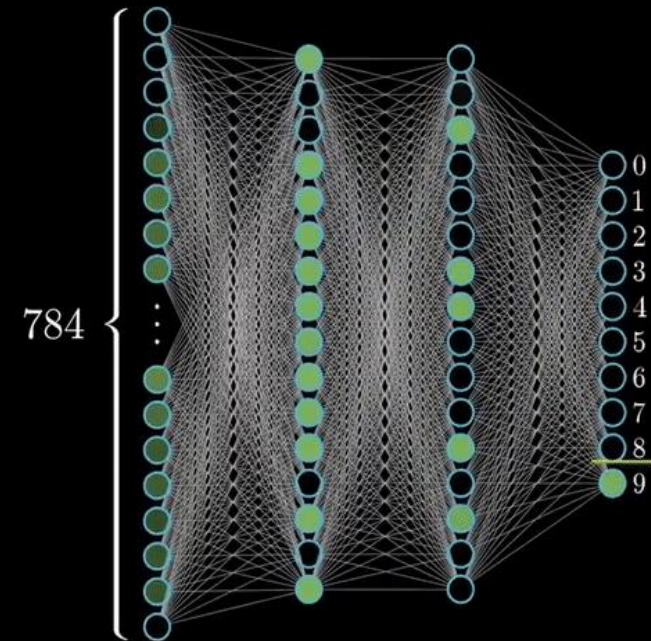
[Erhan et al., Simonyan et al., Zhou et al.] (2015)



# How does a NN propagate input values across layers?



784



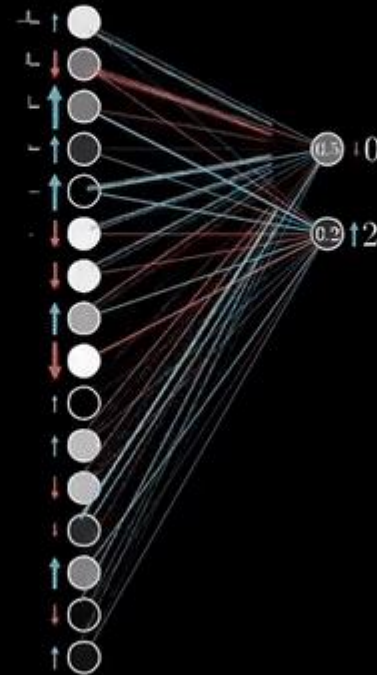
# How does backpropagation work?



Increase  $b$

Increase  $w_i$   
in proportion to  $a_i$

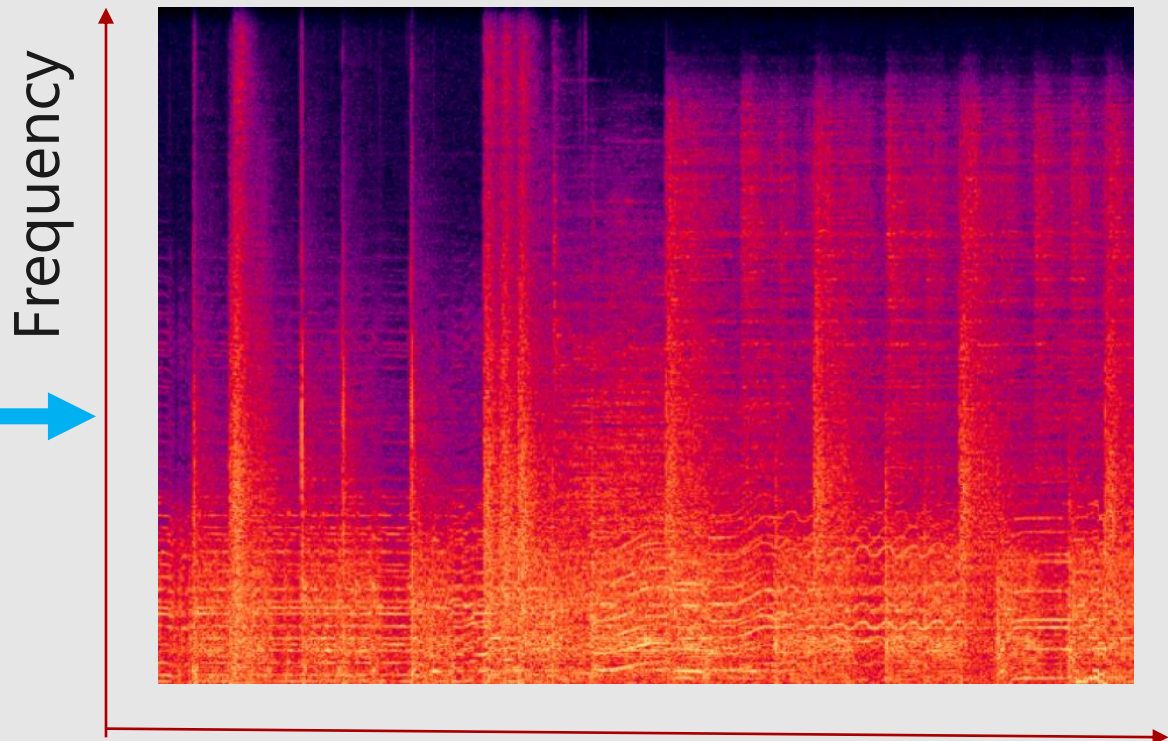
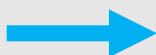
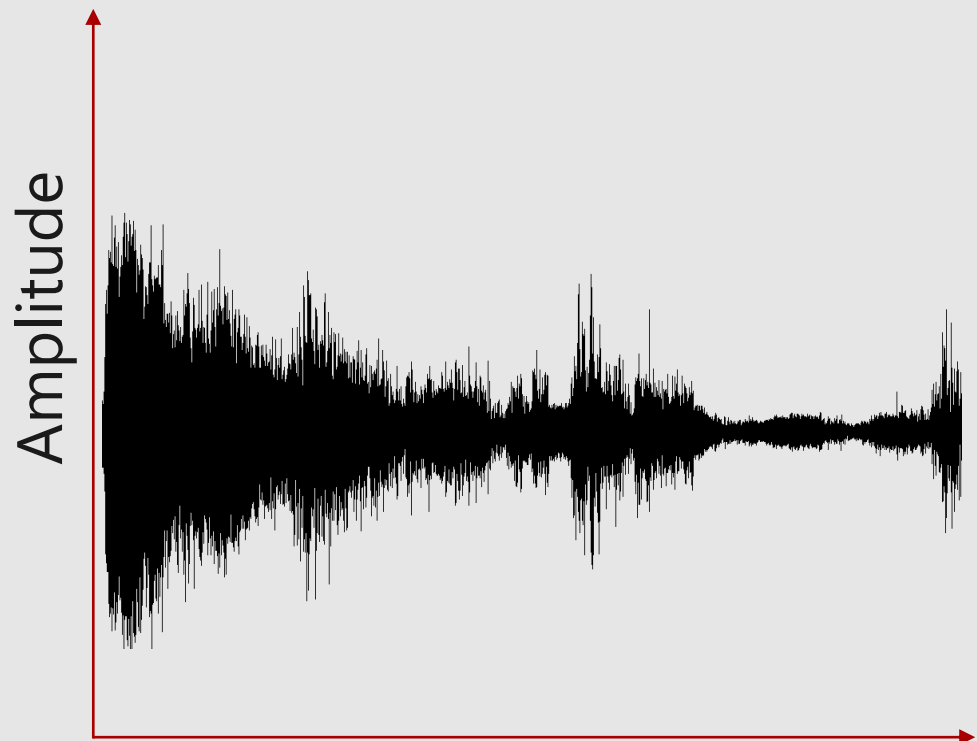
Change  $a_i$   
in proportion to  $w_i$





# From wave to spectrogram

Color = amplitude



Time

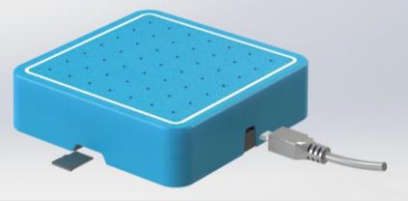
Time

```
array([-0.02746582, -0.02560425, -0.02203369, -0.01846313, . . .])
```

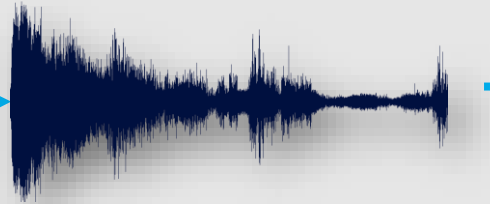
```
array([[1.52478102e+00, 2.05976986e+00, 1.26201334e+00, ...],  
       [2.96875731e+00, 7.89774332e+00, 2.15371033e+01, ...],  
       [1.30643798e+01, 9.32107594e+00, 8.57415558e+00, ...],  
       .  
       .  
       .  
       ]])
```

# High-Level Solution – CNN Model

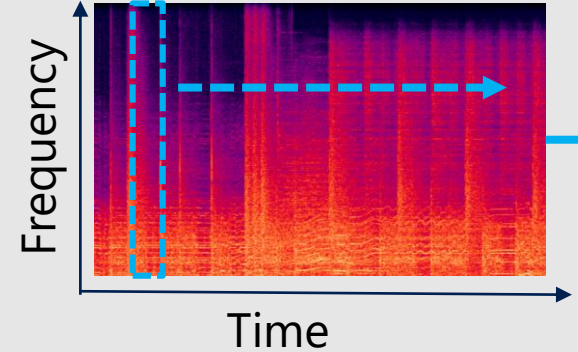
1) Prototype Device



2) Raw Audio Format

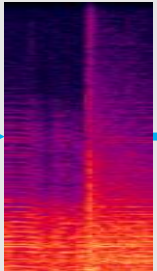


3) Log-Mel Spectrogram

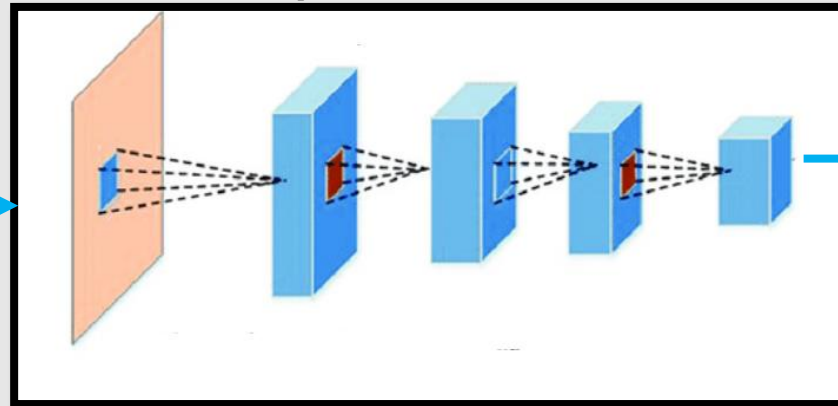


4) Concatenate several spectrogram slices (0.1 sec each)

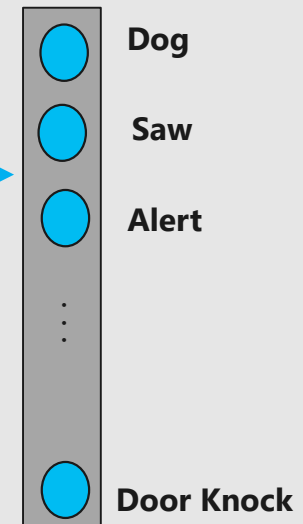
1-second  
(10x64)



5) CNN Model



Prediction Vector



# Link to hands-on workshop

Github:

<https://github.com/thinkgradient/Getting-started-with-ml-dl>

# Resources

The most complete chart of Neural Networks explained:

<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>

Understanding Neural Networks, from neuron to RNN, CNN, and Deep Learning

<https://towardsdatascience.com/understanding-neural-networks-from-neuron-to-rnn-cnn-and-deep-learning-cd88e90e0a90>

Deep Learning Specialization

<https://www.deeplearning.ai/>

Making neural nets uncool again

<https://www.fast.ai/>

CS231n: Convolutional Neural Networks for Visual Recognition (Stanford University)

<http://cs231n.stanford.edu/>

CS230 Deep Learning (Stanford University)

<http://cs230.stanford.edu/syllabus/>

Getting Started With ML and Deep Learning Frameworks

<https://github.com/thinkgradient/Getting-started-with-ml-dl>