
Amsterdam Municipal Department for the Preservation and Restoration of Historic Buildings and Sites (bMA)

Introduction to Deep Learning

DAY 1: Introduction & First Model

DAY 2: Monitoring and Troubleshooting the learning process

DAY 3: Convolutional neural networks & Regularization

09:00 Introduction to Deep Learning

10:20 Coffee break

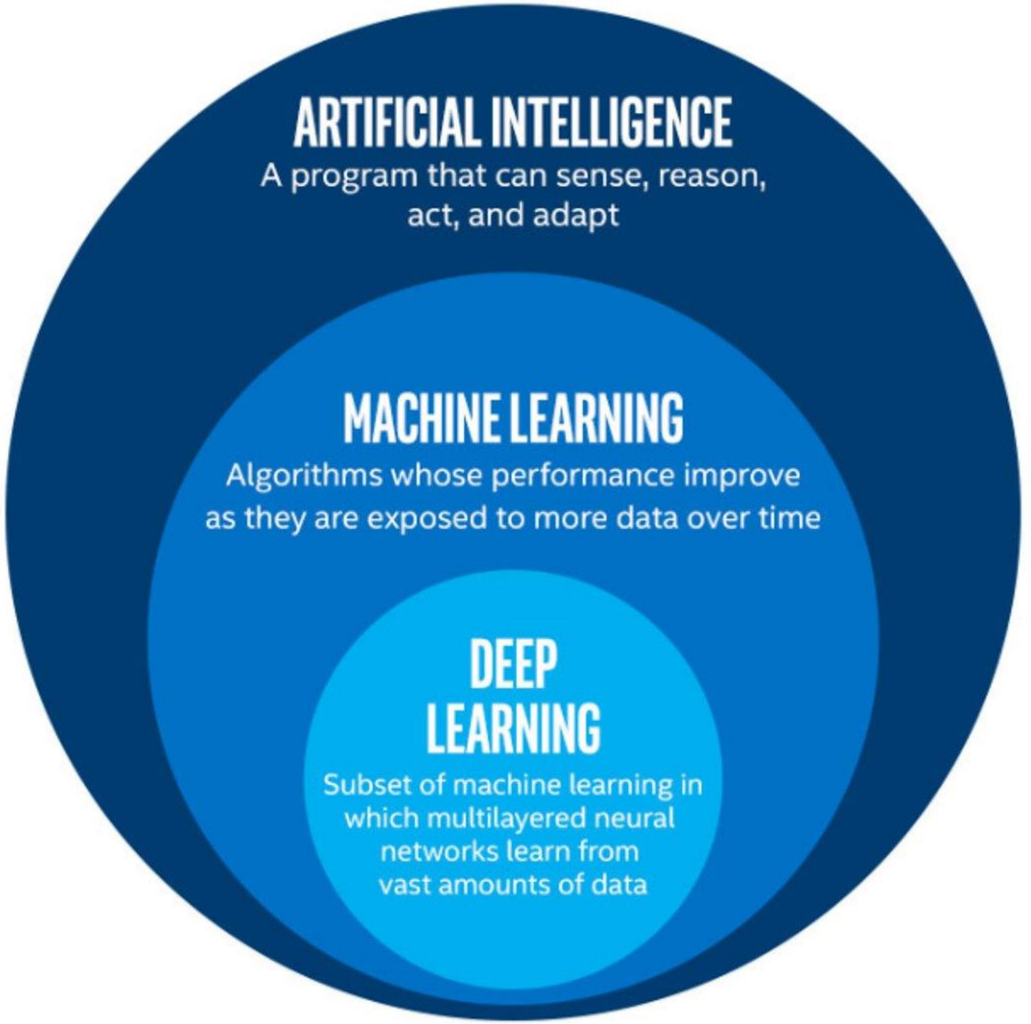
10:30 Creating a neural network for classification

11:20 Coffee break

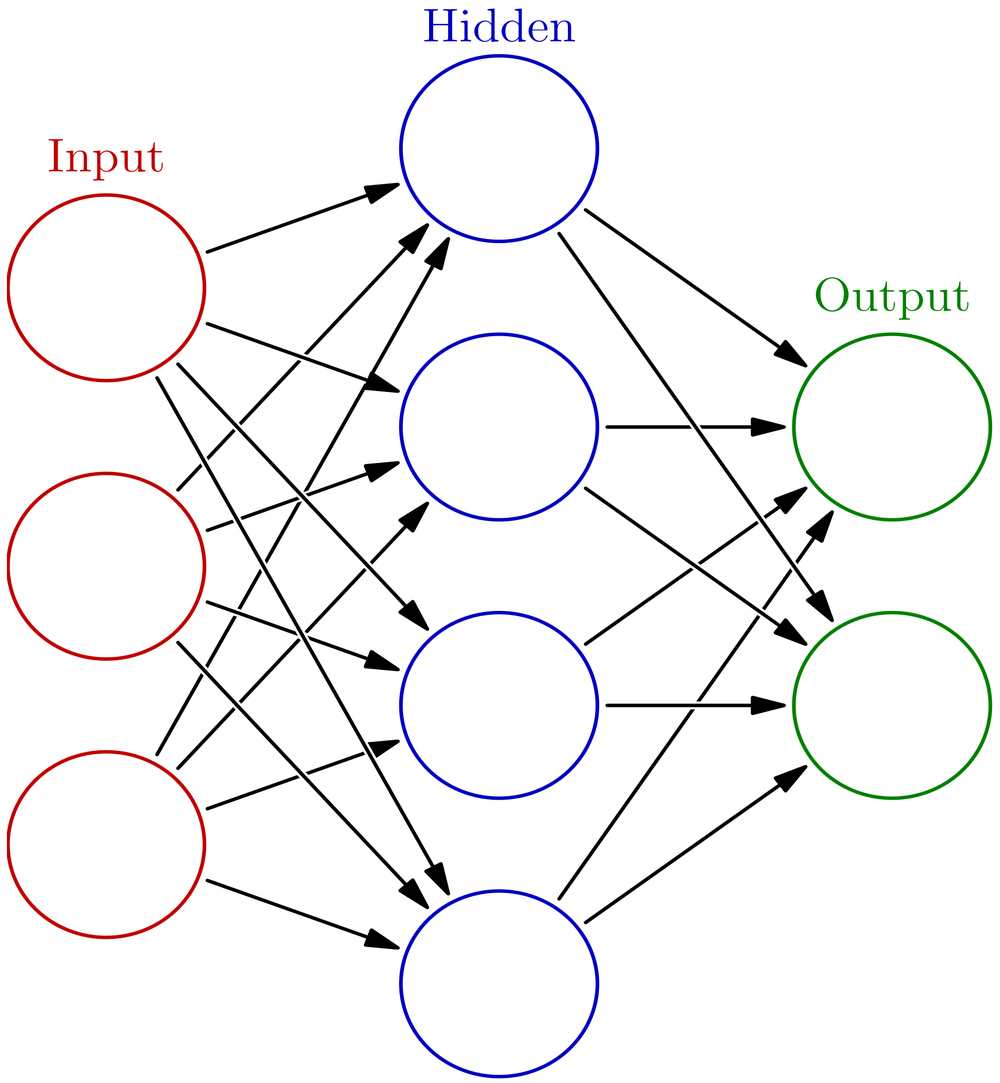
11:30 Monitoring the training process

12:30 END

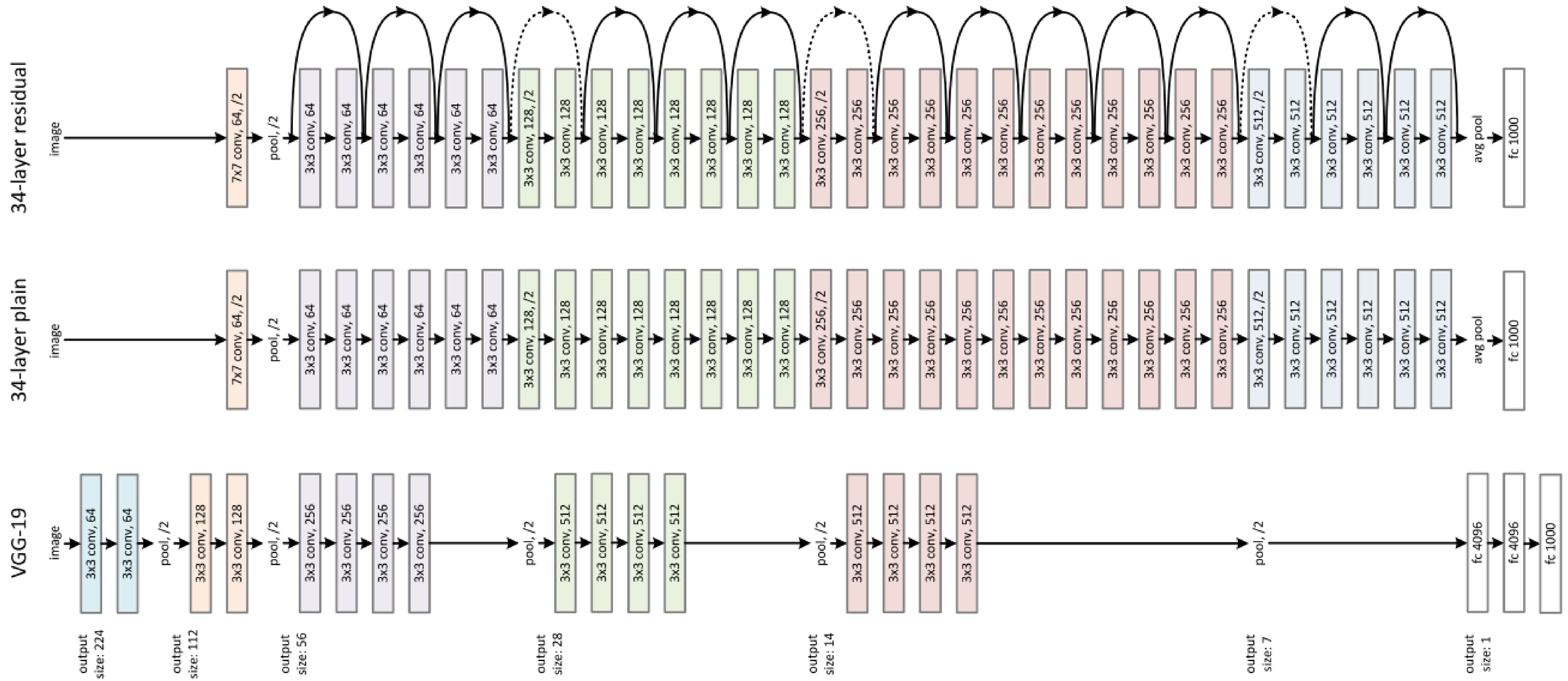
AI Landscape



Neural Network

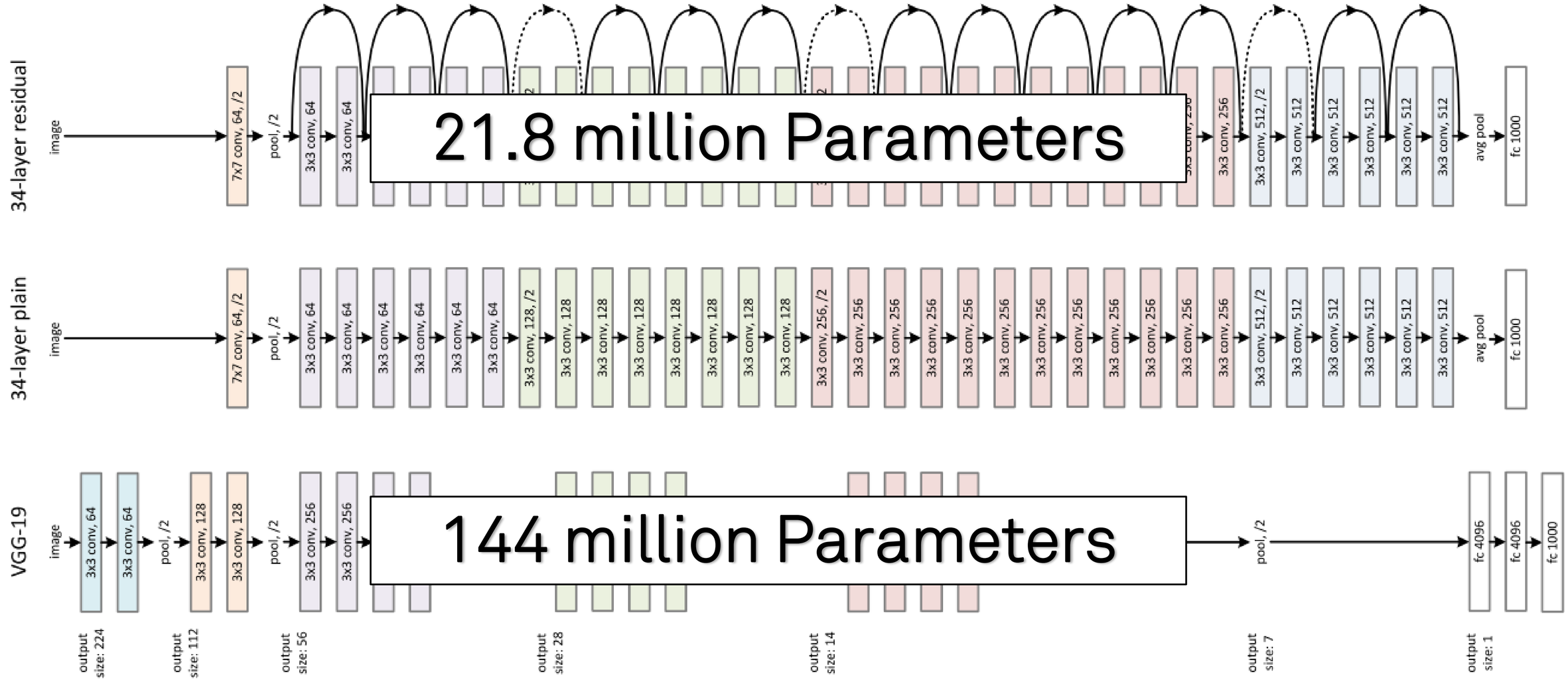


Example Deep Neural Networks



https://www.kaggle.com/keras/resnet50

Example Deep Neural Networks



https://www.kaggle.com/keras/resnet50

What sort of problems can deep learning solve?

What sort of problems can deep learning solve?

- Pattern/object recognition

DOG

CAT

What sort of problems can deep learning solve?

- Segmenting images (or any data)

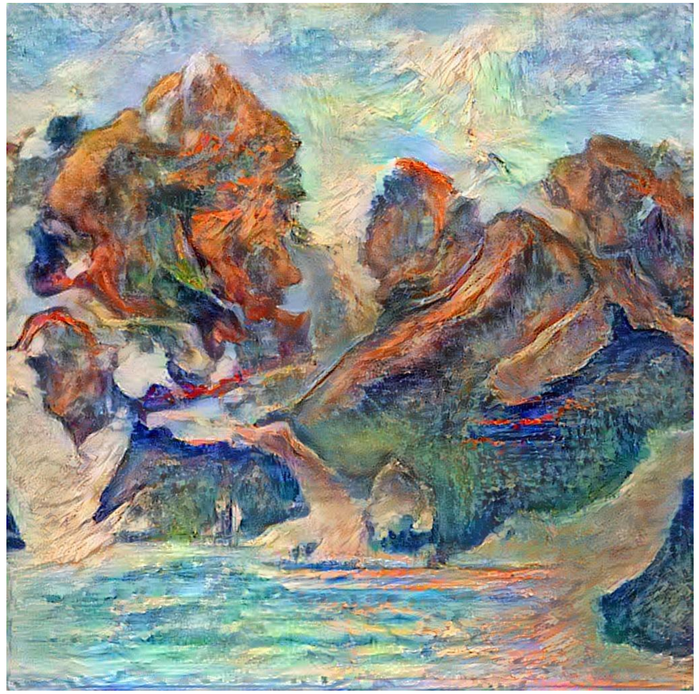
What sort of problems can deep learning solve?

- Translating between one set of data and another, for example natural language translation.

https://blazepress.com/2014/10/36-of-the-funniest-translation-fails-ever/

What sort of problems can deep learning solve?

- Generating new data that looks similar to the training data, often used to create synthetic datasets, art or even “deepfake” videos.



What sort of problems deep learning *cannot* solve?

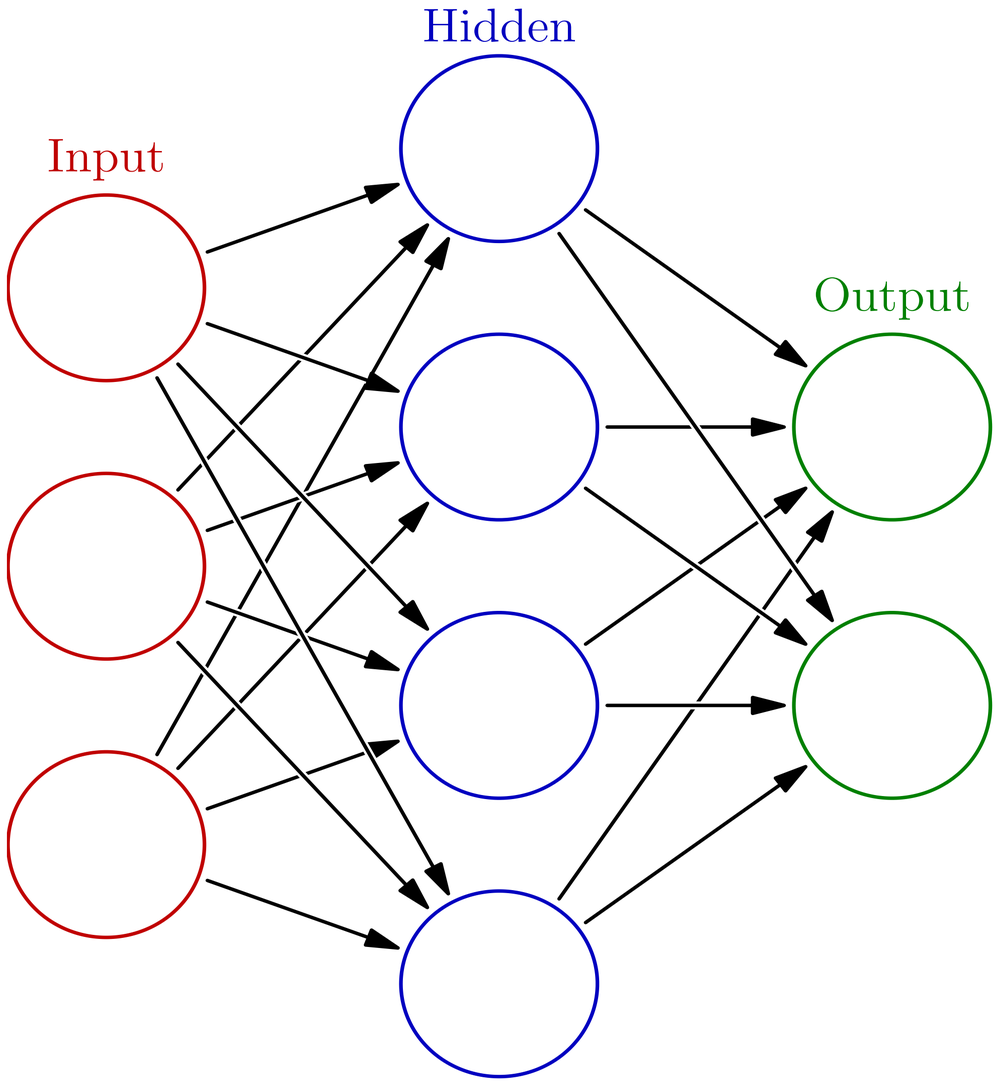
- Where only small amounts of training data is available.
- Tasks requiring an explanation of how the answer was arrived at.
- Being asked to classify things which are nothing like their training data.

Exercise: deep learning problems

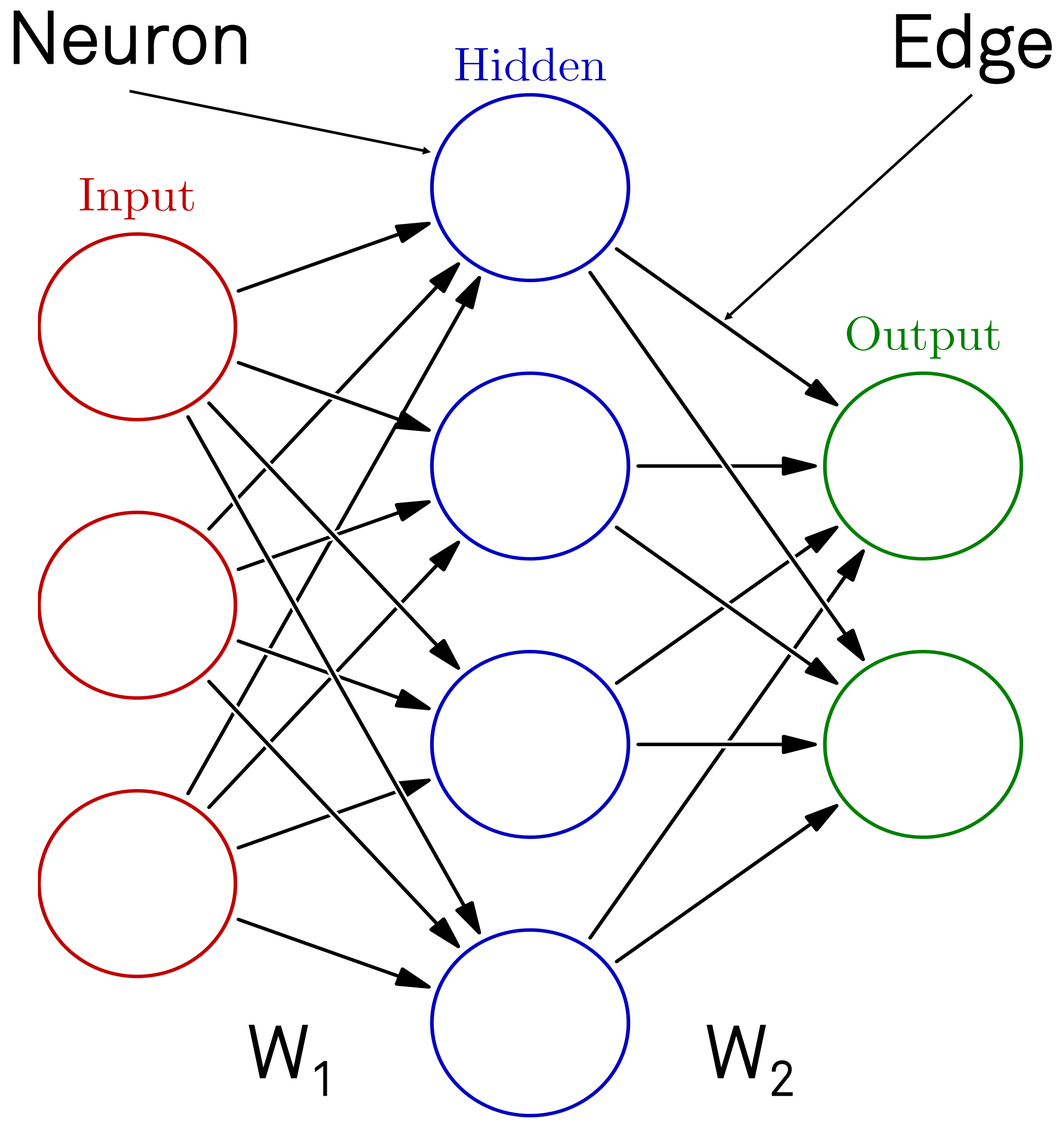
Which of the following would you apply Deep Learning to?

- Recognising whether or not a picture contains a bird.
- Calculating the median and interquartile range of a dataset.
- Identifying MRI images of a rare disease when only one or two example images available for training.
- Identifying people in pictures after being trained only on cats and dogs.
- Translating English into French.

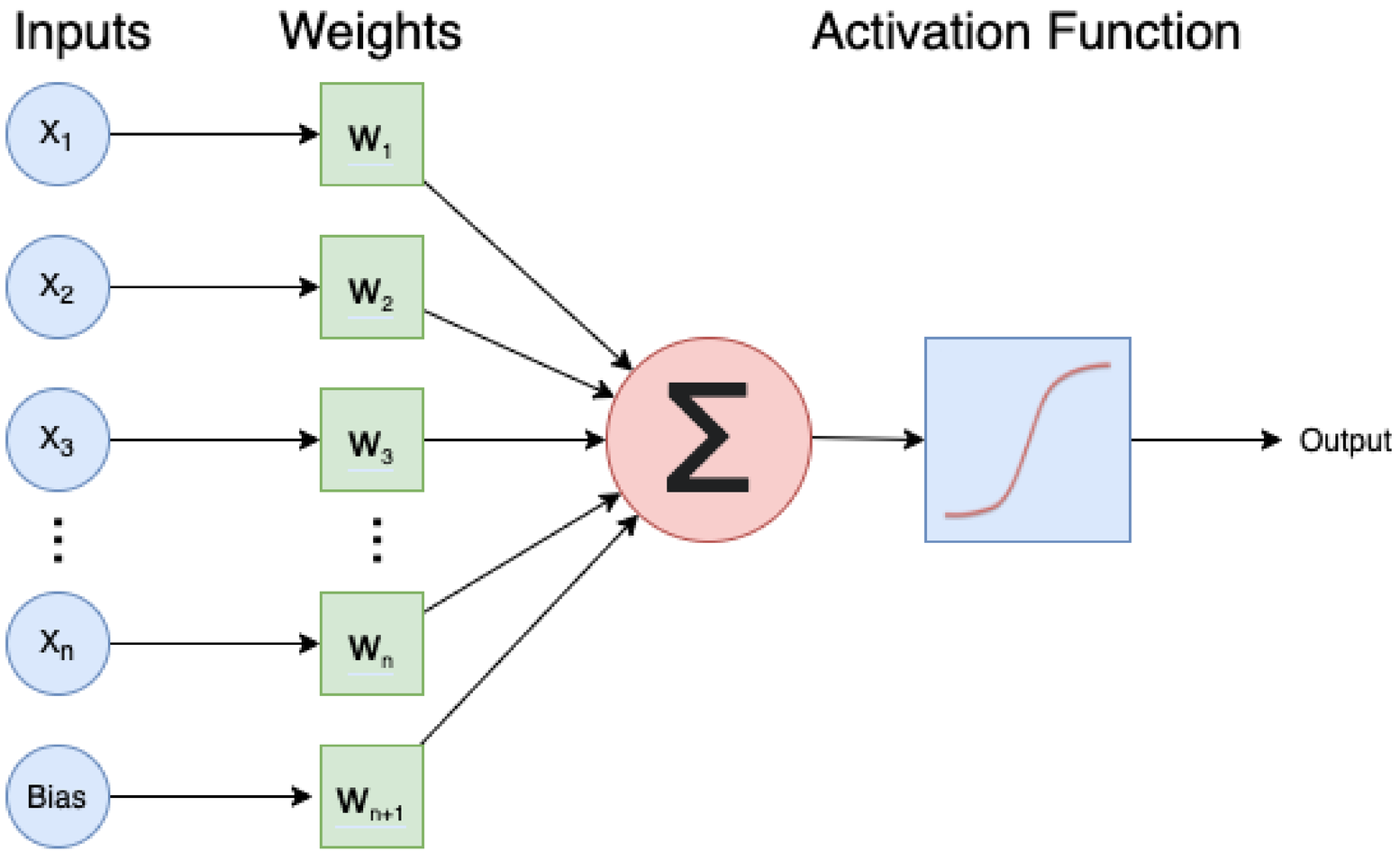
Neural Network



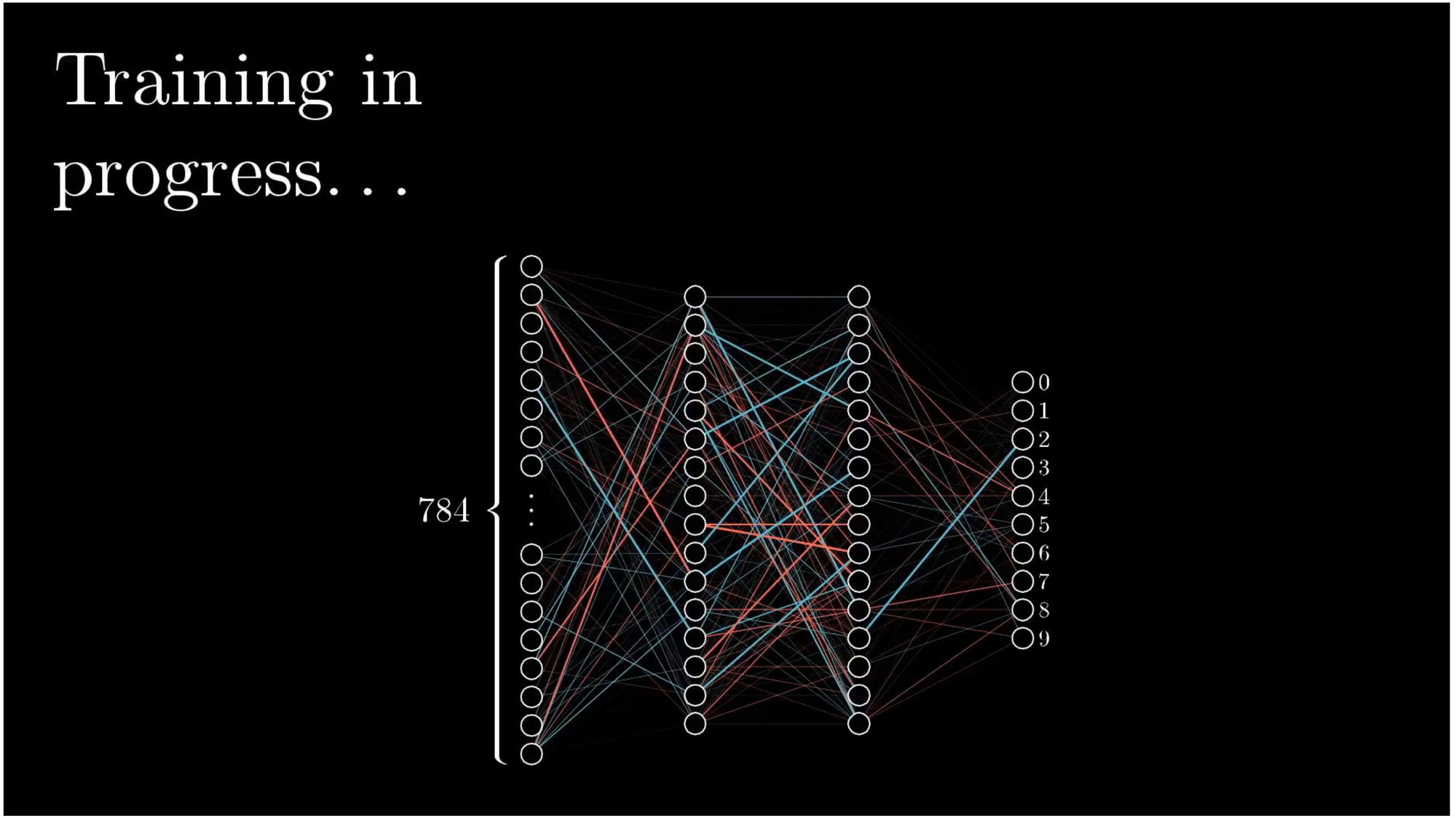
Neural Network



Perceptron

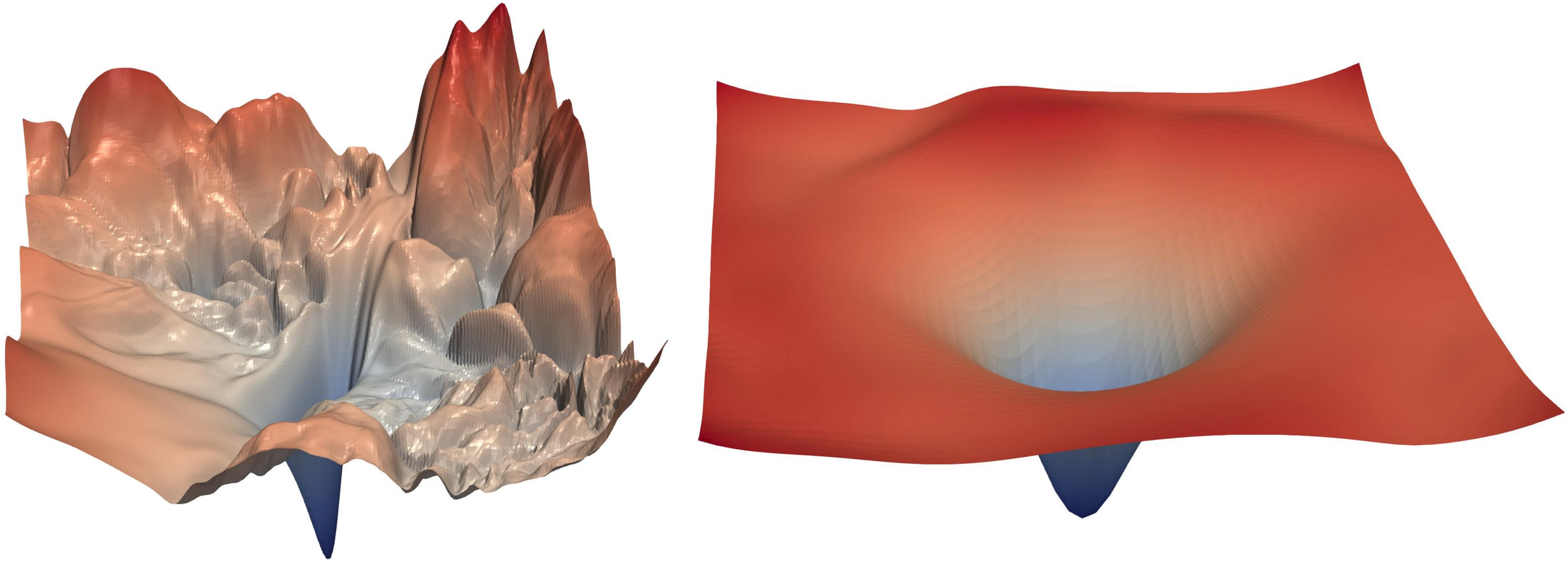

Inputs
Weights
Activation Function
x_1
x_2
x_3
x_n
Bias
w_1
w_2
w_3
w_n
w_{n+1}
Σ
Output

Backpropagation



https://gfycat.com/helpfulconstantkite

Search Landscape of ResNet-56



Li, Hao, et al. "Visualizing the loss landscape of neural nets." *arXiv preprint arXiv:1712.09913* (2017).

Deep Learning Frameworks

- Tensorflow
  - Google
  - General Tensor Network Caculations
- PyTorch
  - Facebook
  - Very Fast
- Keras
  - Designed for Ease of Use
  - On top of Tensorflow
  - Good Documentation
- And many others (Theano, Caffe, etc.)

What we are using

- Keras – Deep Learning Framework
- Sklearn – Machine Learning Framework
- Seaborn – Visualization Library

Exercise: check versions

```
from tensorflow import keras
print(keras.__version__)

import seaborn as sns
print(sns.__version__)

import sklearn
print(sklearn.__version__)
```

Deep Learning Workflow

Deep Learning Workflow

1. Formulate/ Outline the problem
2. Identify inputs and outputs
3. Prepare data
4. Choose a pre-trained model or build a new architecture from scratch
5. Choose a loss function and metrics
6. Train the model
7. Measure Performance
8. Tune Hyperparameters
9. Perform a Prediction/Classification

Exercise: deep learning workflow