Advanced Deep Learning

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POSTECH

Table of Contents

1. Artistic Style Transfer

- Original paper (https://arxiv.org/abs/1508.06576 (https://arxiv.org/abs/1508.06576))

- https://shafeentejani.github.io/2016-12-27/style-transfer/ (https://shafeentejani.github.io/2016-12-27/style-transfer/)
- https://harishnarayanan.org/writing/artistic-style-transfer/ (https://harishnarayanan.org/writing/artistic-style-transfer/)

Artistic Style Transfer for Video

- Vincent van Gogh

In [1]:

```
%%html
<center><iframe src="https://youtube.com/embed/ckqemfh0JMM?rel=0"
width="560" height="315" frameborder="0" allowfullscreen></iframe></center>
```


[iSystems] Video Style Transfer Gogh
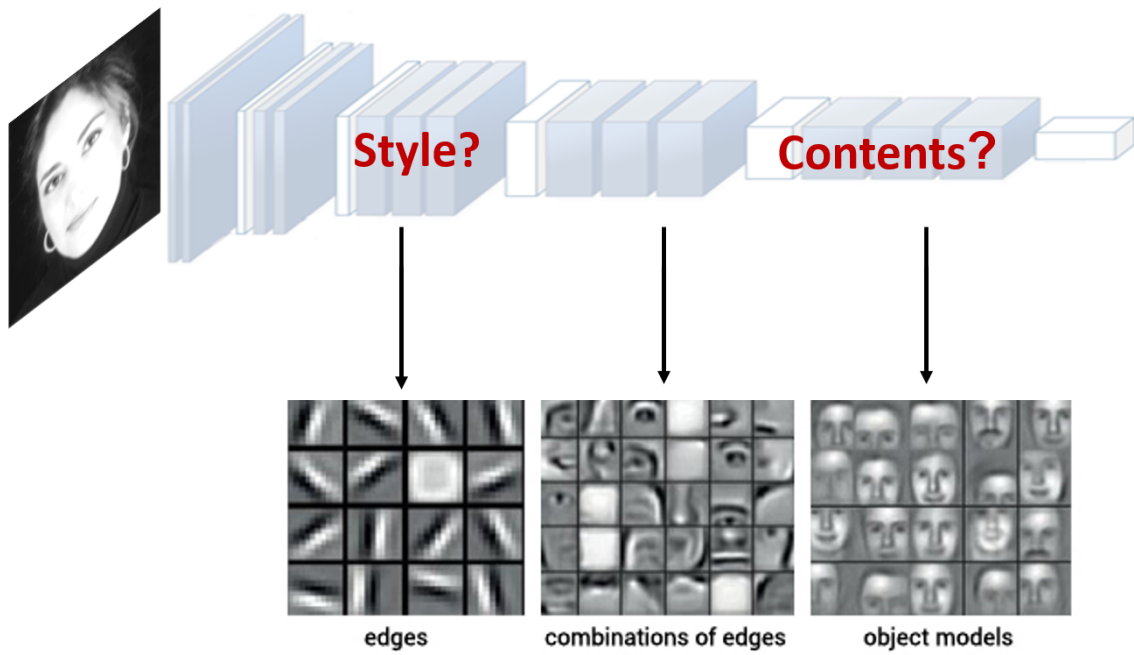
- Picasso

In [2]:

```
%%html
<center><iframe src="https://youtube.com//embed/nMwU4avioVo?rel=0"
width="560" height="315" frameborder="0" allowfullscreen></iframe></center>
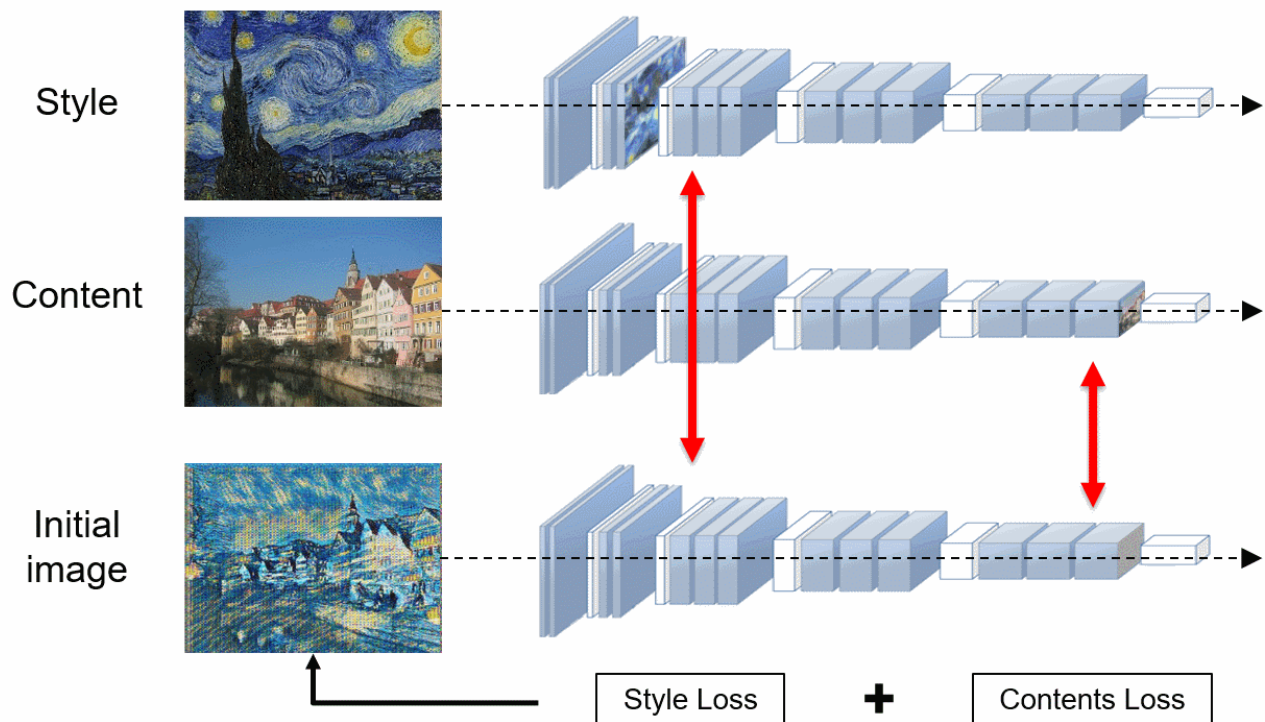```


[iSystems] Video Style Transfer Picasso

**Revisit CNN**

- Hierarchical feature representation
  - Contents representation
  - Style representation



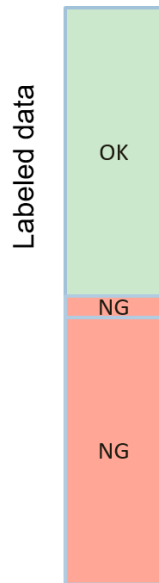| edges | combinations of edges | object models |

**Style Transfer**

- Image construction



Style

Content

Initial image

Style Loss **+** Contents Loss

# 2. Discriminant Model vs. Generative Models
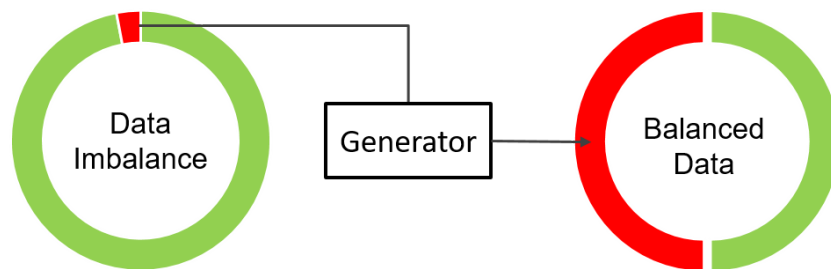
**Imbalanced Data**

- Not enough data from faulty status
- Data Imbalance
    - Under sampling
    - Over sampling
    - Re-weighting
    - (Ada)Boosting

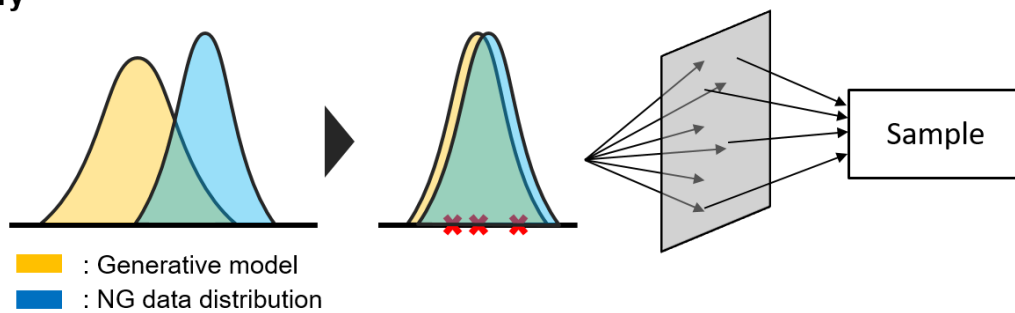$$L(x, y, \theta) = \sum_{i=1}^{N} \omega(y_i) \cdot l(y_i, \hat{y}_i)$$

**Generative Model**

- Data imbalance
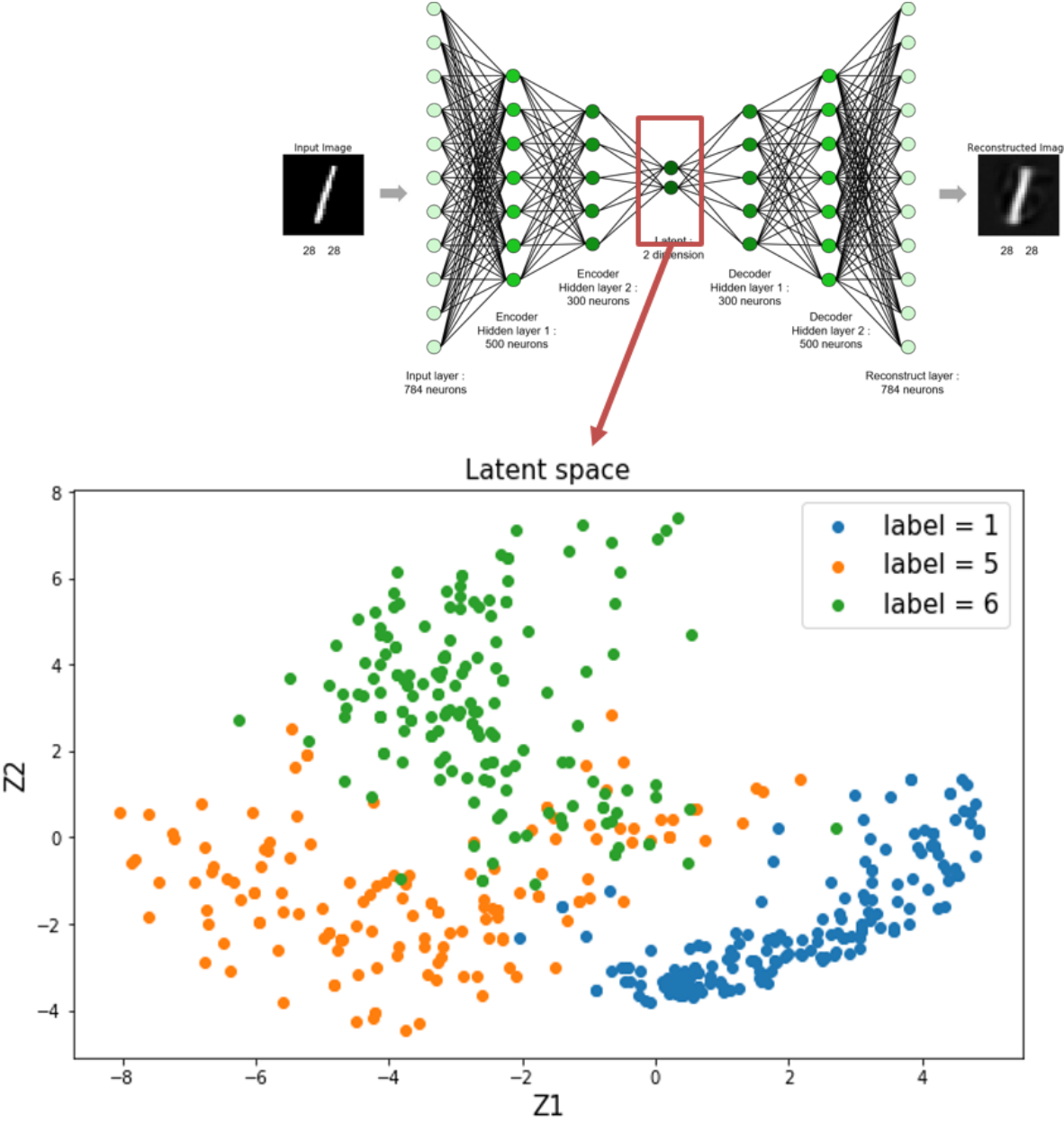  - Problematic in reality
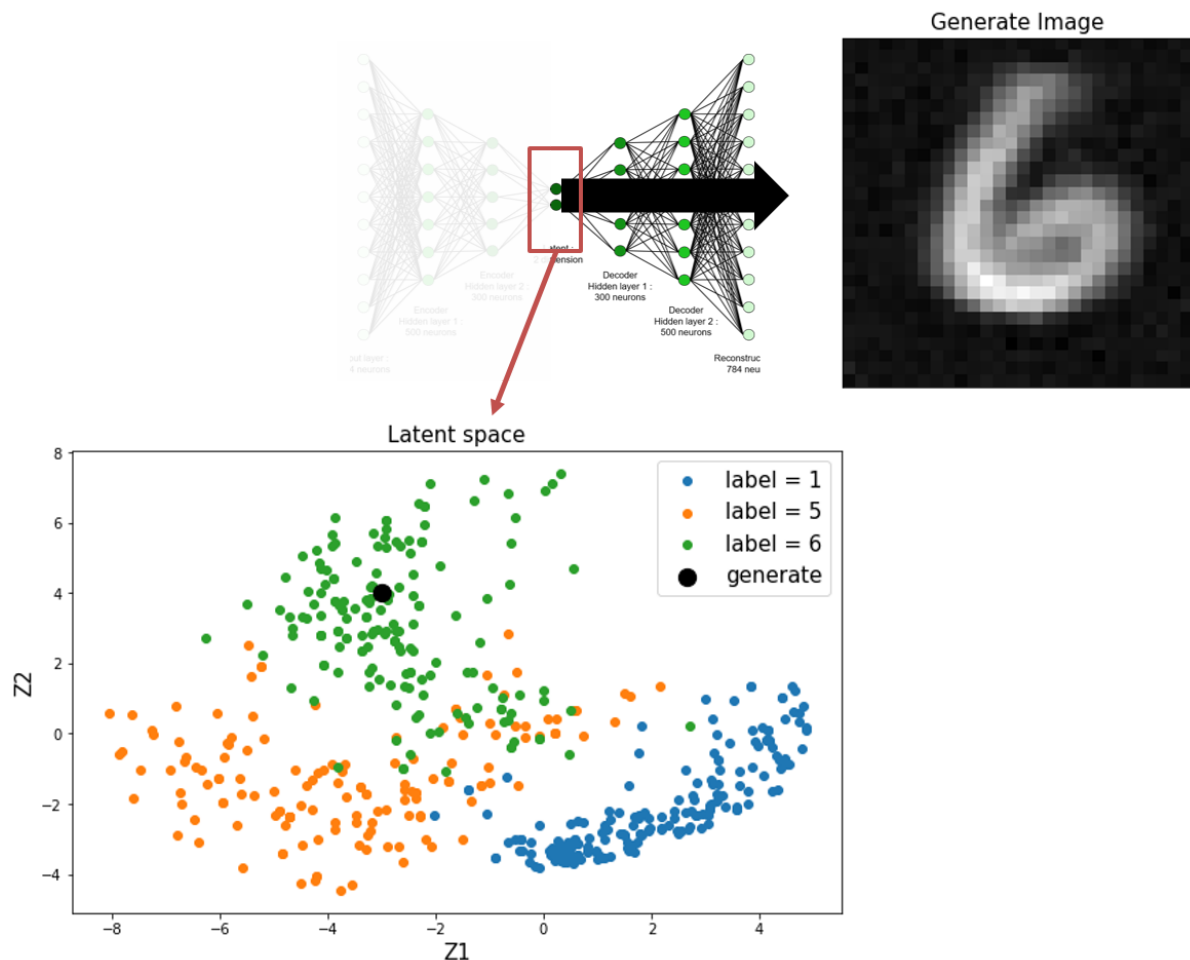  - For example, 98% OK, 2% NG

**Application**

**Theory**

- : Generative model
- : NG data distribution

**Revisit Autoencoder with MNIST Data**

**Data Generation from Decoder**



Generate Image



Latent space

# 3. Generative Adversarial Networks (GAN)

- original paper by Ian J. Goodfellow (https://arxiv.org/abs/1406.2661 (https://arxiv.org/abs/1406.2661))

- https://blog.openai.com/generative-models/ (https://blog.openai.com/generative-models/)

**Turing test**
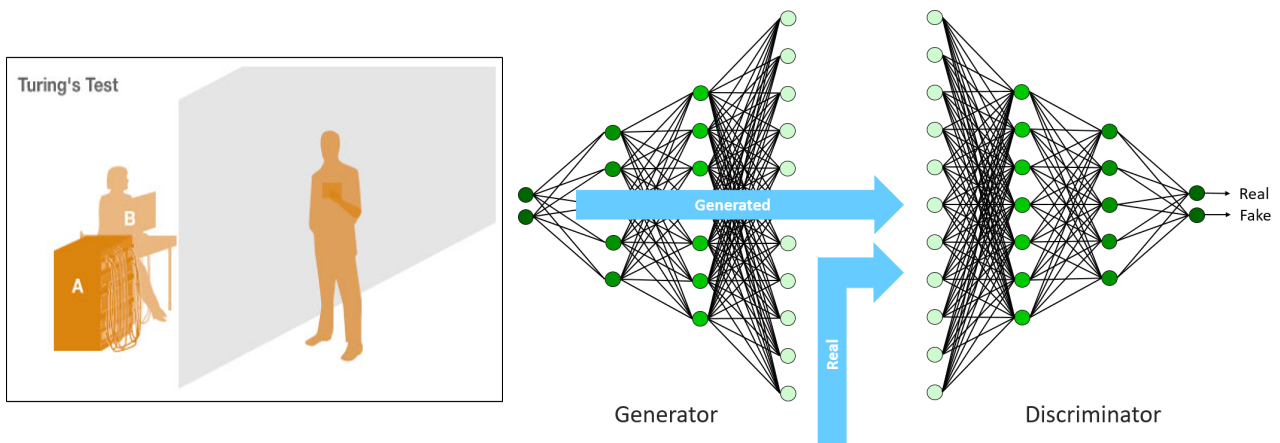
- How to generate data?
  - Train through competition
  - Generator vs. Discriminator



$$H(D(G(z)), 1) + H(D(x), 0)$$

Real Data

$x \sim p_{data}(x)$

$z \sim p_z(z)$

Generator Network

$G(z)$

Prior

Generated Data

Discriminator Network

$D(x)$

1: Fake

0: Real

$$H(D(G(z)), 0)$$
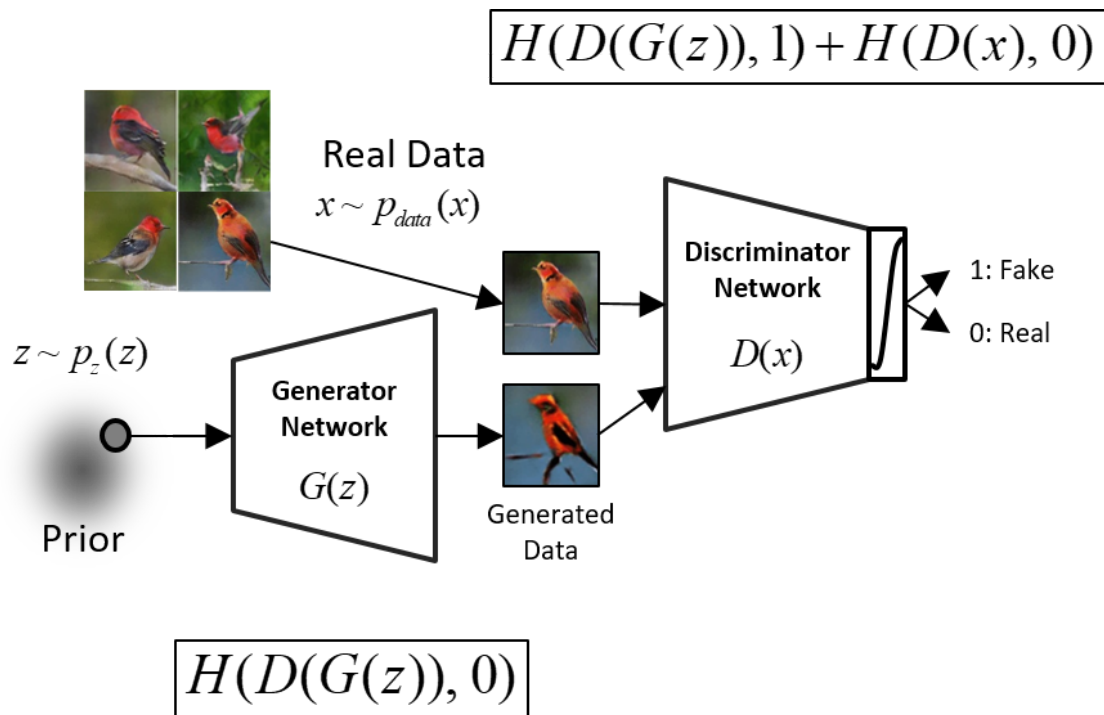
# 4. Deep Learning Implementation

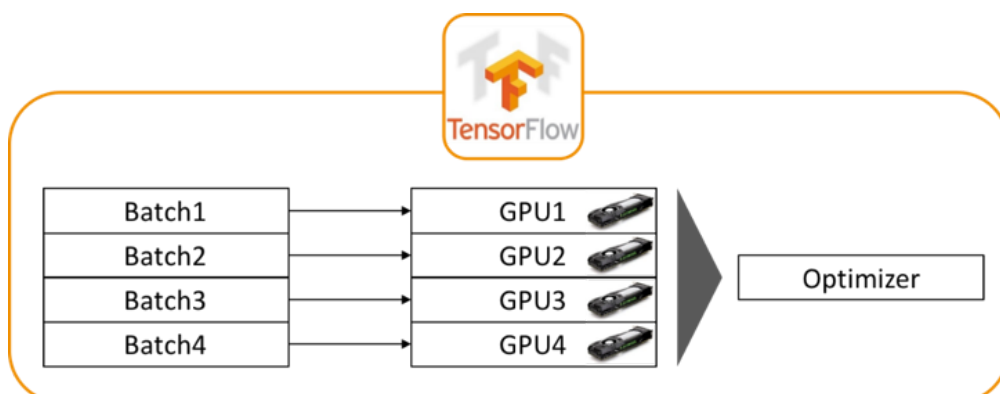**Computation Environment for Model Learning**

- Development environment (open source)
  - Ubuntu 14.04
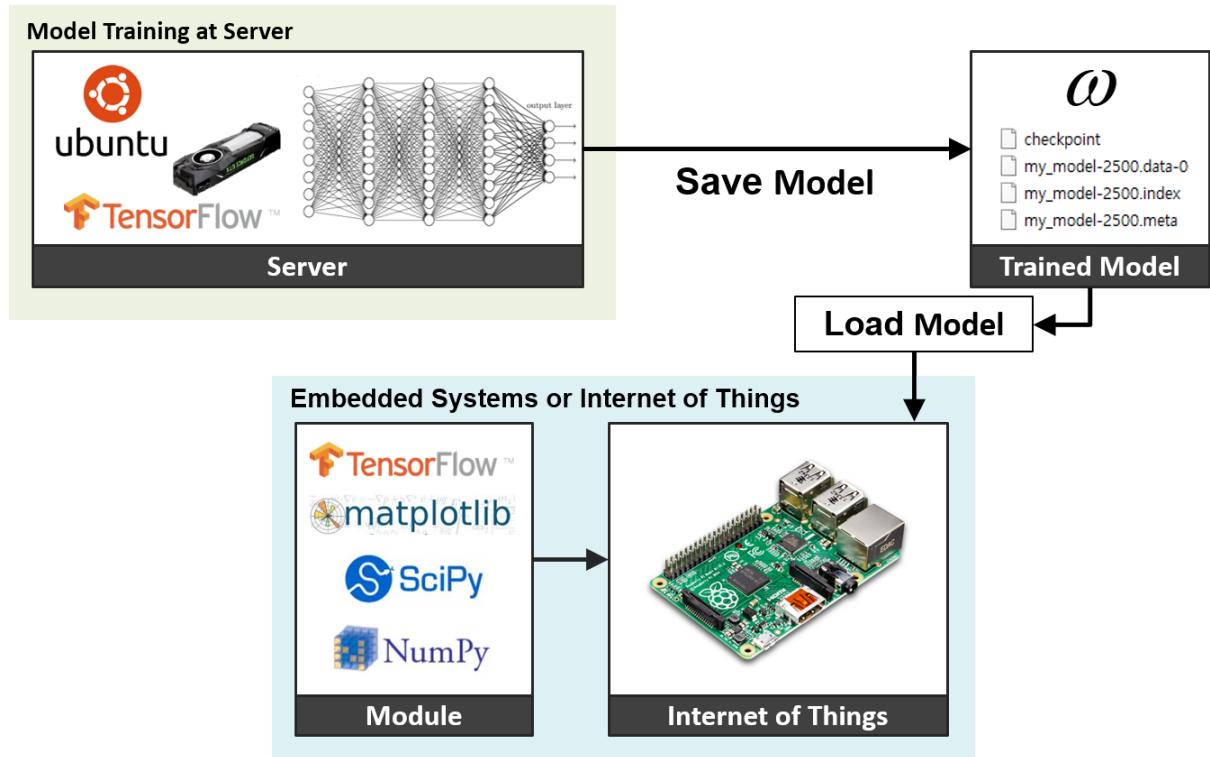  - Python3
  - TensorFlow



- Machine
  - GPU: GeForce GTX TITAN X (PASCAL)
  - CPU: Intel i7-5930k 6 Core 3.5GHz processor



- Parallel computing
  - Multi GPUs

# Implementation of Deep Learning Model



In [3]:

```
%%html
<center><iframe src="https://www.youtube.com/embed/-eqVRXtX44Y?rel=0"
width="560" height="315" frameborder="0" allowfullscreen></iframe></center>
```

[iSystems] Deep Learning on Raspberry Pi

In [4]:

```
%%javascript
$.getScript('https://kmahelona.github.io/ipython_notebook_goodies/ipython_notebook_toc.js')
```