# DeepLearning_SkypeGroup_20180402

April 2, 2018

## 1 Today's Topic: What is Convolution?

### 1.1 Let's explore more about the theoretical aspect of deep learning

#### 1.1.1 Part I

- In probability/signal processing/differential equation,we also see this term.

- Brief review about CNN

    - Processing grid-format data
        * Time series (1D)
        * Image (2D)
        * ...

- Mathematical foundation

    - Mathematical operation
        * A kind of moving average
        * Input,Kernel function and Feature map(ouput)
        * Communative property due to flip operation

- Convolution in DL

    - Implementation in the DL packages: Cross Correlation (without flip)
    - Sparse interactions(sparse connectivity)
        * $O(m*n)$ to $O(k*n)$
    - Parameter sharing
        * Tied weight
    - Equivalent representations
        * Equivariant
        * Receptive field
    - Convolution as a infinitely strong prior
        * Prior probability distribution

- Cognitive science foundation

- Primary visual cortex(V1)
    * Simple cell
    * Complex cell
    * "Grandma cell"
- IT()
- Fovea()
    * Saccade
    * Attention
- Garbor function
    * Quadrature pair

### 1.1.2 Part II

- An toy model of CNN (without any DL computation framework)

    - Run the code
    - Description for the detail about convolution function in the code

### 1.1.3 Reference:

- https://github.com/oreilly-japan/deep-learning-from-scratch
- Deep Learning, by Ian Goodfellow, Yoshua Bengio and Aaron Courville