Sprint 1 Presentation

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Photonics Chips for Machine Learning

Background

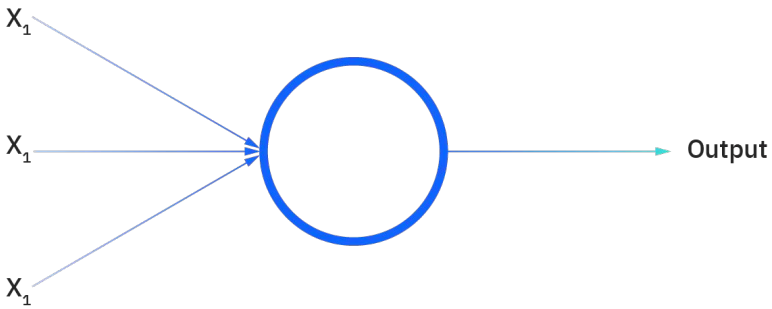
- What is photonics integrated circuit(PIC)?
  - Similar to electronic integrated circuits
  - Using photonic flow instead of electron flow for transmission
  - Having higher speed on data processing and transmission
  - Ex: Fiber-optic communication
- What is machine learning?
  - ML is the study computer algorithms that can improve automatically through experience and by the use of data
  - Training data to predict or decide the next step
  - Ex: neural networks

Our Product - Photonics Image Processor

- ➔ Background
- ➔ Introduction
- ➔ Product Mission
- ➔ MVP & User Stories
- ➔ Technologies
- ➔ Development Environment

Neural Networks

- Allow computers solve common problems like human brains
- Subset of machine learning and heart of deep learning
- Many types, mainly focus on CNNs
  - CNNs: convolutional neural networks



$$a = f(\sum_{i=0}^{N} w_i x_i)$$

Deep neural network

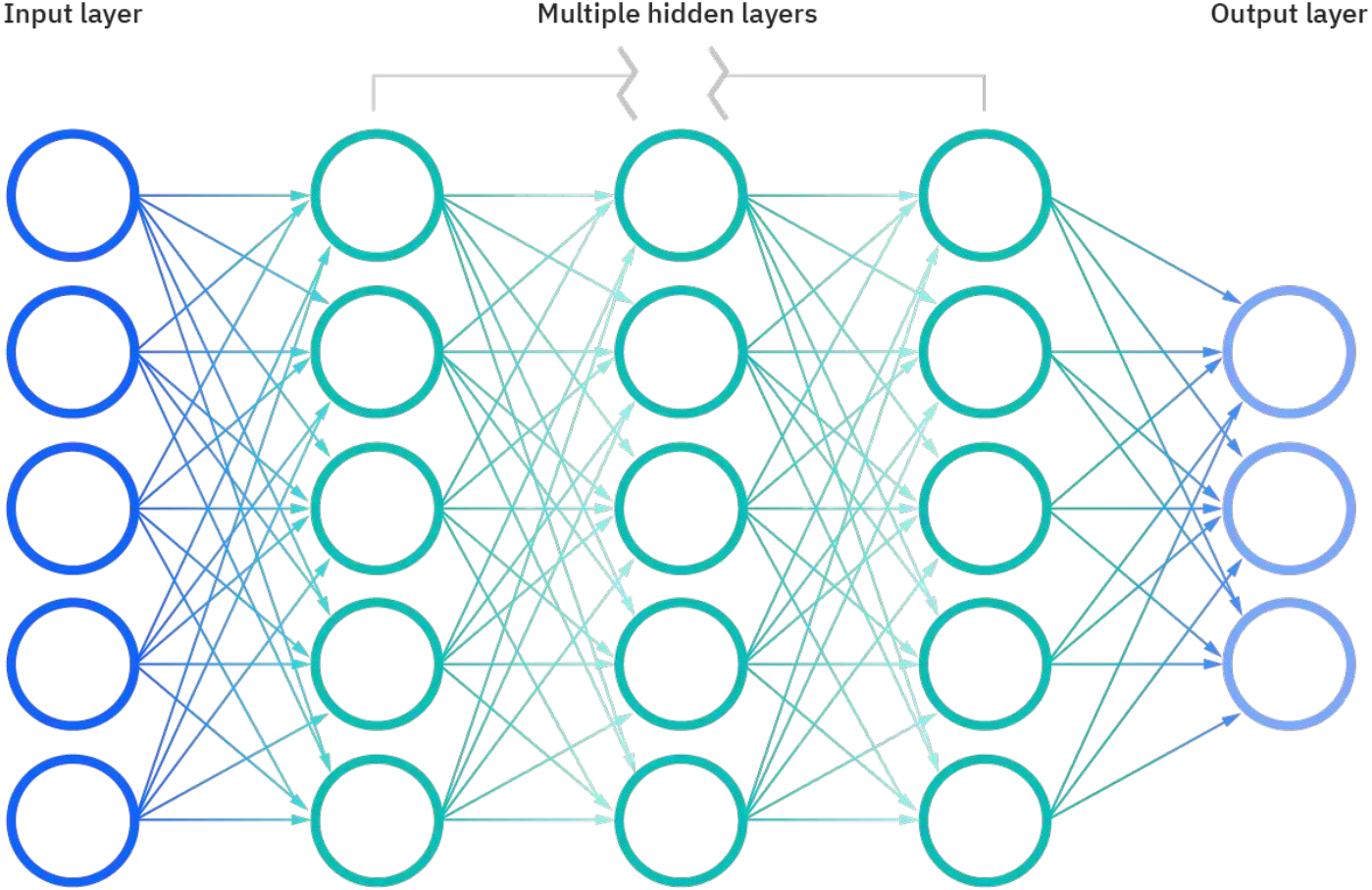
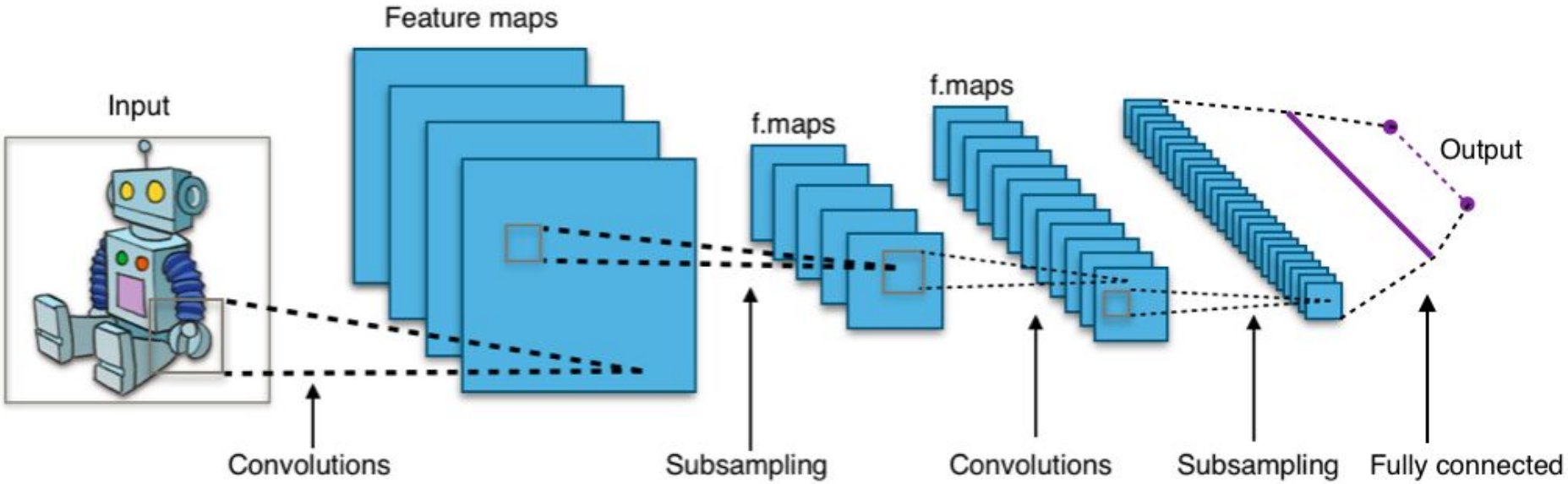
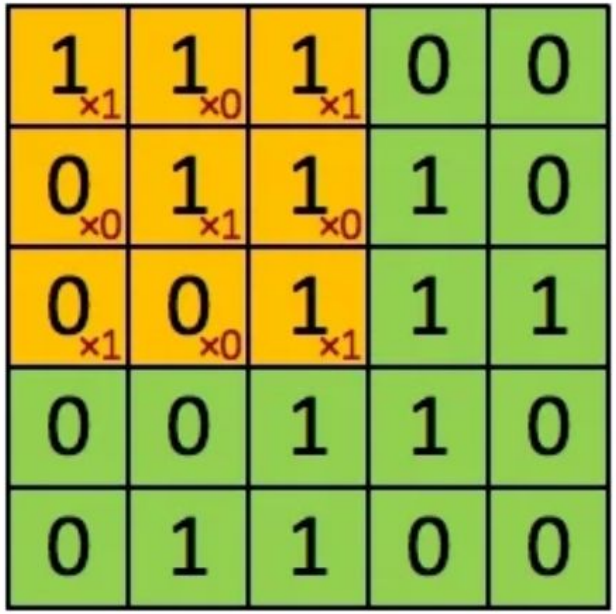
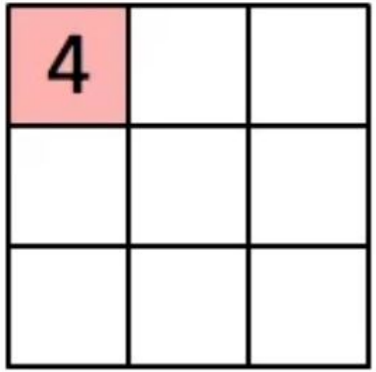


Image Processing With CNNs





Image



Convolved Feature

Introduction

- Using CNNs for image processing
  - CNN is mainly used in image recognition and object detection
- Optical CNNs or CNNs accelerator
  - Can improve processing speed

Product Mission

- Detect or recognize things in images or videos automatically
- Having faster speed on image processing than the usual image processor
- Having high accuracy on recognizing important features in images

MVP

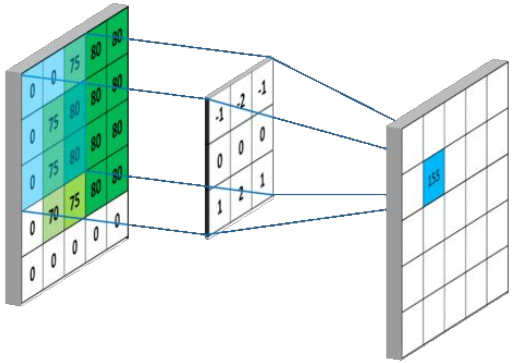
- Can detect the main features in images or videos
- Dealing with multiple things in images or videos
- Using optical CNNs to speed our images processor

User Stories

- Government:
  - Use face recognition to find criminals
- Smartphone users:
  - Unlock phone with face recognition
  - Find things online by taking a photo

Technologies

- Photonics chips
  - Software only, maybe use simulator to test our circuit
  - Photonics convolutional accelerator / build CNNs with optics
- Machine Learning - CNNs
  - Better for image processing



Development Environment

- Language: Python
- Environment: Keras/OpenCV
  - Keras: providing an interface for neural networks
  - OpenCV: providing an interface for ML and neural networks

Thank you for listening!

Reference

- https://www.intechopen.com/chapters/69955
- https://www.ibm.com/cloud/learn/neural-networks
- https://en.wikipedia.org/wiki/Convolutional_neural_network
- https://towardsdatascience.com/convolution-neural-network-for-image-processing-using-keras-dc3429056306
- https://www.analyticsvidhya.com/blog/2021/06/image-processing-using-cnn-a-beginners-guide/