AI and Processor Advancements

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Outline

❯ AI: What the Technology Can Do Today

❯ The Rise of AI

❯ Why AI Is Succeeding Now?

❯ Processor Advancements Supporting AI

❯ Summary

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AI: What the Tech Can Do Today

CNET Video

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AI: What the Tech Can Do Today

❯ Consumer AI

❯ Supervised Learning

❯ Transportation AI

❯ Health Care AI

❯ Agriculture AI

❯ Retail AI

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IBM Deep Blue beats Kasparov
IBM Watson wins Jeopardy

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Google DeepMind AphaGo beats Lee Sedol

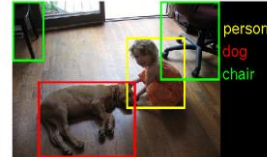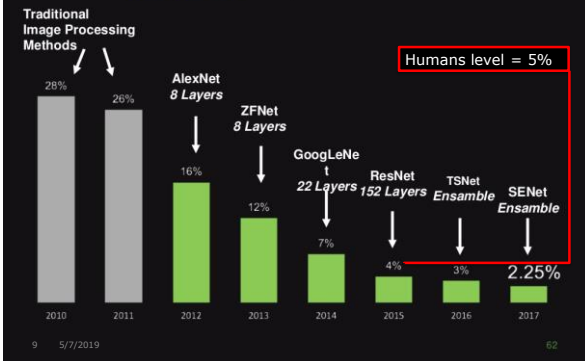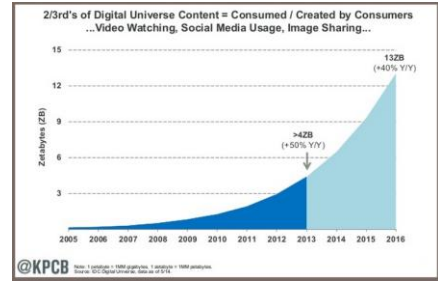7   5/7/2019

ILSVRC Challenge

- ImageNet Large Scale Visual Recognition Challenge
- An image classification challenge with 1,000 categories (1.2 million images)

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ImageNet Top 5 Error Rate

Humans level = 5%

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Autonomous Vehicles

Can eliminate 94% of crashes due to human error and inattention.

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The Rise of AI

- AI is beating humans in:
  - Games
  - Information retrieval and analysis
  - Recognition
  - Classification
  - Autonomous vehicles
  - ...
- AI has accuracy and cost advantages

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Why AI Is Succeeding Now?

1. Data availability
2. Better algorithms
3. Processor advancements

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1. Data Availability

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2. Better Algorithms

› Machine Learning
› Deep Neural Networks (DNN)
› Convolutional Neural Networks (CNN)
› Recurrent Neural Networks (RNN)
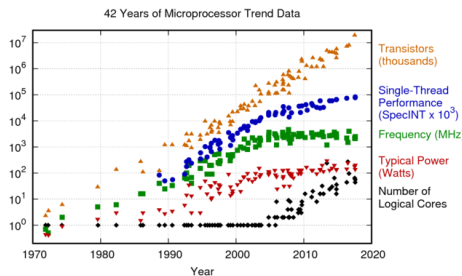› Reinforcement Learning

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3. Processor Advancements

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Processors for AI

› Conventional processors don't provide needed performance for AI

› What AI needs?

› How new processors provide it?

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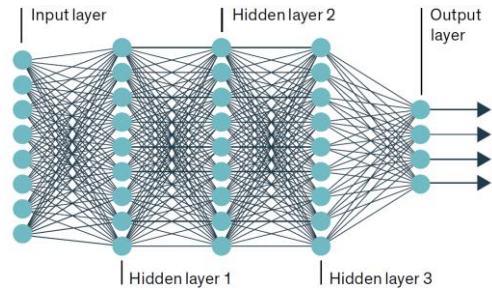
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Machine and Deep Learning

› **AI**: a branch of computer science dealing with the simulation of intelligent behavior in computers.

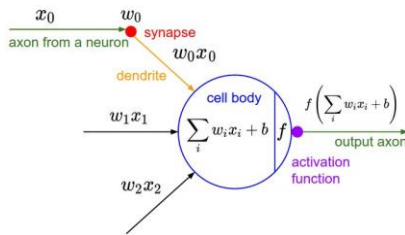› **ML**: focuses on the development of computer programs that can access data and use it to learn for themselves.
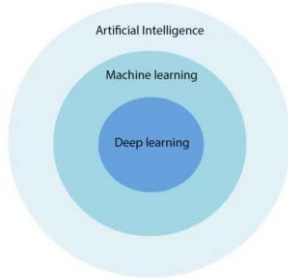
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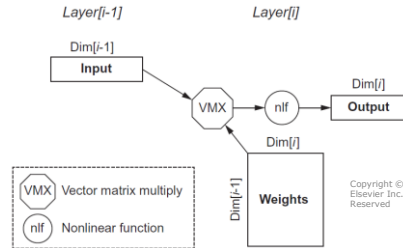
Deep Neural Networks

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Neural Network Computations

$$f\left(\sum_i w_i x_i + b\right)$$

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Neural Network Computations

› Repetitive multiply/add and nonlinear function

VMX   Vector matrix multiply

nlf   Nonlinear function

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Example: Deep Neural Networks

Nvidia Titan V

› Graphics Processing Unit (GPU) for deep learning

› Contains 21 billion transistors

› Price = $3,000

› Performance: 110 Tera FLOPS

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Contains 84 SMs, each has 64 FP32, 64 INT32, 32 FP64, and 8 tensor cores
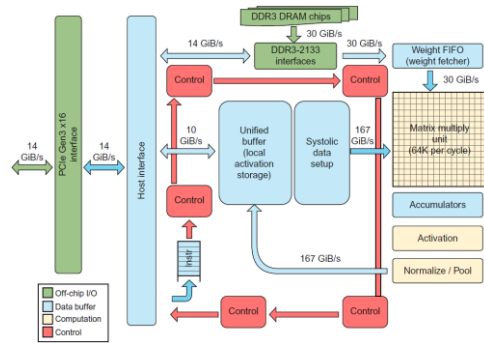

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Comparison

› Training a neural network to diacritize Arabic text.

Year	Processor/Library	Training Time
2014	Intel i7 / RNNLIB	17 days
2016	GPU / CURRENNT	1.25 hours

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Google's Tensor Processing Unit

TPU Microarchitecture

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Summary

› Efficient AI solutions are becoming available for many sectors.
› AI is progressing very fast.
› AI is succeeding now due to
  − Availability of training data
  − Better algorithms
  − Higher computer performance
› New processors are designed to server AI.

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Thank you

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