Artificial Intelligence

- YouTube Video: "I am AI" from Nvidia
- https://youtu.be/SUNPrR4o5ZA

Outline

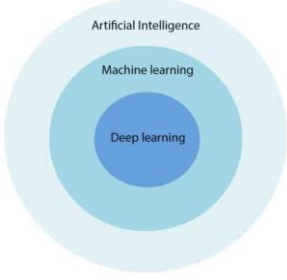
- Introduction to AI and ML
- My Experience with ML
- Emerging Disruptive Technologies
- Why AI Is Succeeding Now?
- Disruptions to Our Lives
- How I Can Learn ML?
- Summary

Introduction to AI and ML

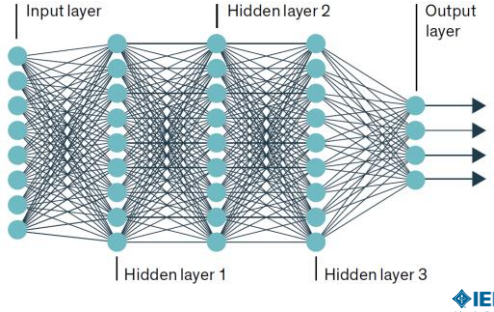
- AI, ML, Deep Learning?
- **Types**: Supervised, Unsupervised, etc.
- **Applications**: Classification, Regression, Clustering, Recommendation, Transcription, etc.

Introduction to AI and ML

- **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.



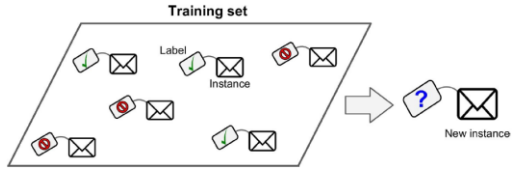
Deep Neural Networks



ML Types and Applications

- **Types**
  1. Supervised
  2. Unsupervised
  3. Semi-supervised
  4. Reinforcement
- **Applications**
  1. Classification
  2. Recognition
  3. Authentication
  4. Regression
  5. Clustering
  6. Anomaly detection
  7. Recommendation
  8. Transcription

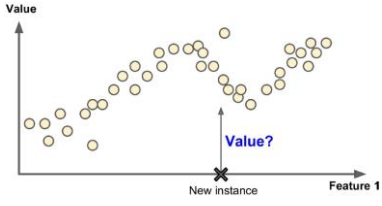
1. Supervised Learning



The training data you feed to the algorithm includes the desired solutions, called *labels*

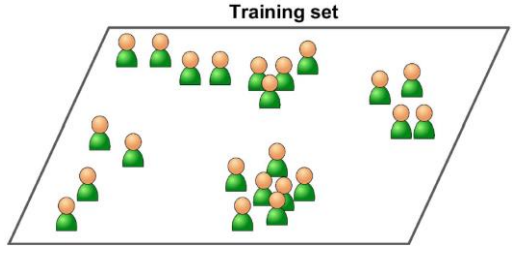
Classification: finds the class, e.g., email type (spam or ham)
Recognition
Authentication

1. Supervised Learning



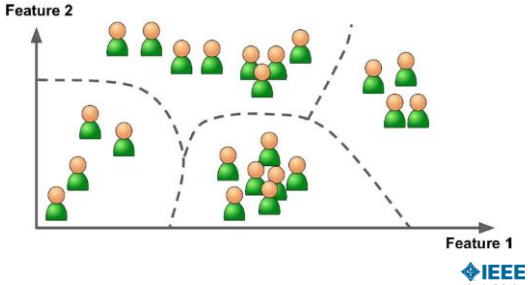
Regression: finds the value, e.g., car price

2. Unsupervised Learning

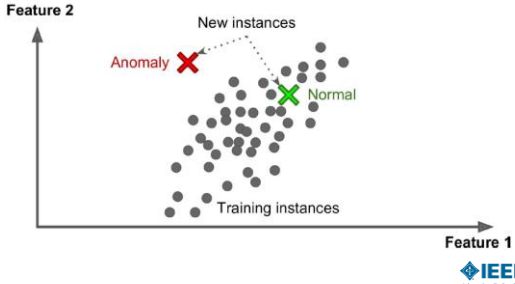


The training data is unlabeled.

2.a Unsupervised ML in Clustering

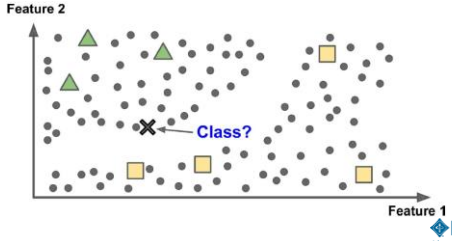


2.b Unsupervised ML in Anomaly Detection



3. Semi-supervised Learning

Partially labeled training data, usually a lot of unlabeled data and a little bit of labeled data. E.g., Google Photos.



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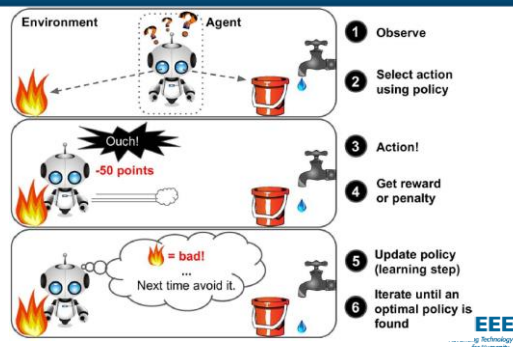
4. Reinforcement Learning



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Recommendation Systems

- A **Recommender System** predicts the likelihood that a user would prefer an item and it recommends items to the user.
- **Examples**:
  - Facebook—"People You May Know"
  - Netflix—"Other Movies You May Enjoy"
  - LinkedIn—"Jobs You May Be Interested In"
  - Amazon—"Customer who bought this item also bought …"
  - Google—"Visually Similar Images"
  - YouTube—"Recommended Videos"

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Sequence Transcription

- Translating a sequence of one type to the corresponding sequence of another type.
- **Examples**:
  - Translating English to Arabic
  - Speech recognition
  - Optical character recognition
  - Automatic diacritization of Arabic text
  - Handwritten recognition and synthesis

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17 6/10/2018

My Experience with ML

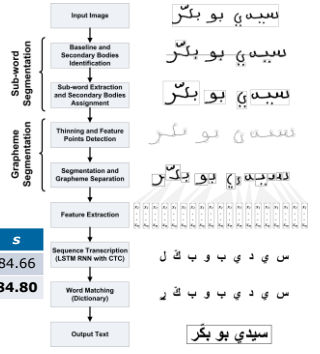
1. Recognizing Handwritten Arabic Words

2. Diacritizing Arabic Text

18 6/10/2018

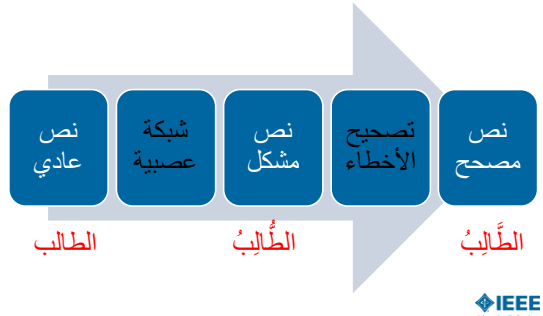
Recognizing Handwritten Arabic Words

- My main research interest since 2006
- 2011: Started to use Recurrent Neural Networks (RNN)
- Alex Graves



System	d	e	f	s
MDLSTM2	98.57	**94.76**	**94.13**	84.66
JU-OCR2	**98.96**	93.46	92.46	**84.80**

Diacritizing Arabic Text



Diacritizing Arabic Text

كتب الطالب رسالة

كَتَبَ الطَّالِبُ رِسَالَةً

Systems	Error
Zitouni et al. (2006)	5.5
Habash and Rambow (2007)	4.8
Rashwan et al. (2011)	3.8
Said et al. (2013)	3.6
Abandah et al. (2015)	**2.7**

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

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Emerging Disruptive Technologies

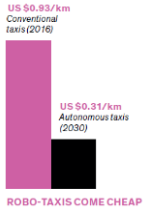
- Autonomous vehicles
  - Cars
  - Truck
  - Ships
  - Drones
- Automation of jobs
  - Blue-collar jobs
  - White-collar jobs

Autonomous Ships

Source: Spectrum, Feb 2017

- Safer, more efficient, and cheaper to run
- Larger cargo capacity and lower wind resistance
- Difficult to board and easier to free

Singapore's nuTonomy



Source: Spectrum, Jan 2017

Google Waymo

- Started in 2009
- 2.5 million miles
- 1 billion simulated miles

- Spectrum, Jan 2017
  - The Dawn: now-2020
  - Mixed Mode: 2020-2040
  - Autonomous Era: 2040 and beyond

Amazon's Drones

WANT IT NOW: Amazon is testing a hybrid drone that takes off and lands vertically but flies like a plane to its destination. Such drones could one day speed packages to consumers.

Source: Spectrum, Jan 2017

Emerging Disruptive Technologies

√ Autonomous vehicles
- Cars
- Truck
- Ships
- Drones

- Automation of jobs
  - Blue-collar jobs
  - White-collar jobs

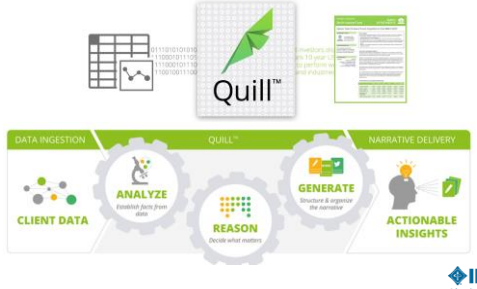
Robots that Learn: Baxter

3D Vision: Industrial Perception's Boxes Robot (Acquired by Google)

IBM Deep Blue and IBM Watson

Google DeepMind AphaGo

Analytical Robots: Narrative Science Quill



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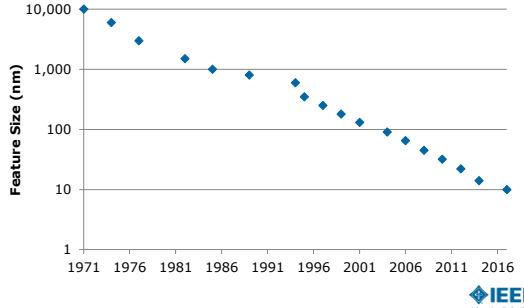
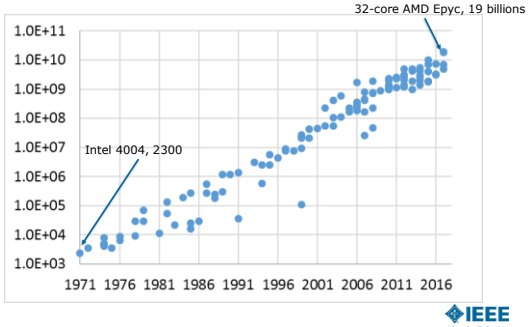
Why AI Is Succeeding Now?

1. Data availability
2. Better algorithms
3. Recent processor advancements

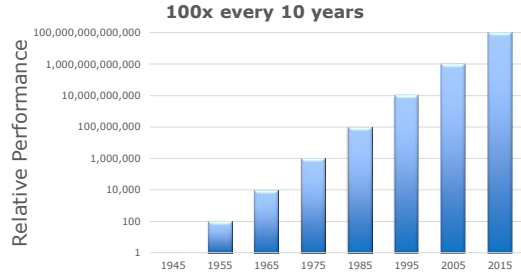
Semiconductor Technology Advances



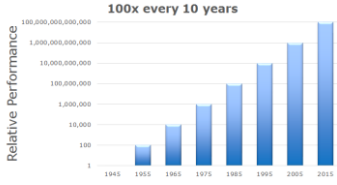
Exponential Increase in Transistors



Recent Processor Advances

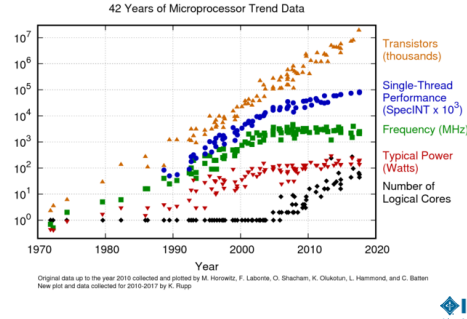


Recent Processor Advances



10 times performance improvement doubles the computer applications.

Exponential Increase in Cores



Nvidia Titan V

- Graphics Processing Unit (GPU) for deep learning
- Contains 21 billion transistors
- Price = $3,000
- Performance: 110 Tera FLOPS

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

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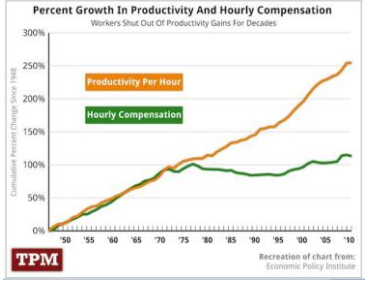
Disruptions to Our Lives

- Abundance of high-quality products and services
- Improved Quality of life
  - –Physical and psychological health
  - –Social relationships
  - –Environment

Negative Effects on the Individual Income



Other Challenges

IEEE Advancing Technology for Humanity

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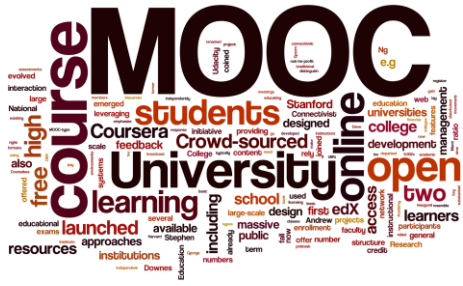
How I Can Learn ML?

- Take a course
- MOOC
- Learn Python
- Learn Scikit-Learn
- Learn TensorFlow

MOOC



Learn Python

- Multi-purpose (Web, GUI, Scripting, etc.)
- Object Oriented
- Interpreted
- Strongly typed and Dynamically typed
- Focus on readability and productivity

Scikit-Learn

- Scikit-learn is a free software machine learning library for the Python programming language. It features various classification, regression and clustering algorithms.

```
import numpy as np
from sklearn.datasets import load_iris
from sklearn.linear_model import Perceptron

iris = load_iris()
X = iris.data[:, (2, 3)]  # petal length, petal width
y = (iris.target == 0).astype(np.int)  # Iris Setosa?
per_clf = Perceptron(random_state=42)
per_clf.fit(X, y)

y_pred = per_clf.predict([[2, 0.5]])
```


Google TensorFlow

- TensorFlow is an open-source software library for dataflow programming across a range of tasks. It is a symbolic math library, and is also used for machine learning applications such as neural networks.

```
import tensorflow as tf

feature_columns = tf.contrib.learn.infer_real_valued_columns_from_input(X_train)
dnn_clf = tf.contrib.learn.DNNClassifier(hidden_units=[300, 100], n_classes=10,
                                         feature_columns=feature_columns)
dnn_clf.fit(x=X_train, y=y_train, batch_size=50, steps=40000)
>>> dnn_clf.evaluate(X_test, y_test)
{'accuracy': 0.98180002, 'global_step': 40000, 'loss': 0.073678359}
```


Summary

- AI is progressing very fast
- AI is succeeding now due to
  - Availability of training data
  - Better algorithms
  - Higher computer performance
- Huge life disruptions are expected
- Learn Python, Scikit-Learn, and TensorFlow

Thank you

- Email: abandah@ieee.com
- Facebook: gheith.abandah
- Twitter: @abandah
- LinkedIn: gheith-abandah
- Website: http://www.abandah.com/gheith