

# Machine Learning

## Introduction to the Course

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This set of notes is based on internet resources.

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- Machine learning is the science of getting machines to learn and act in a **similar way to humans** while also autonomously **learning from real-world interactions** and sets of **training data** that we feed them.
- Machine learning is an application of artificial intelligence (AI) that provides systems the ability to **automatically learn and improve from experience without being explicitly programmed**. Machine learning focuses on the development of computer programs that can **access data and use it** learn for themselves.

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- Machine Learning is a set of methods that automatically **detect patterns in data**, **use the uncovered patterns** to for prediction or decision making.

# Machine Learning (and AI) is Very Hot

Countries and companies invest heavily in ML and AI.

Who will capture the value of AI?\*

7	Nations	     								
6	Corporates	<table><tr><td>Healthcare  </td><td>Finance &amp; Insurance   J.P.Morgan</td><td>Tech &amp; Telco  Microsoft  Baidu</td><td>Agriculture MONSANTO  </td><td>Automotive  </td><td>Legal &amp; Compliance ALLEN &amp; OVERY </td><td>Industrials, GENERAL ROBOTICS  BOEING </td><td>Retail, media, other Disney  TARGET</td></tr></table>	Healthcare  	Finance & Insurance   J.P.Morgan	Tech & Telco  Microsoft    Baidu	Agriculture MONSANTO  	Automotive  	Legal & Compliance ALLEN & OVERY 	Industrials, GENERAL ROBOTICS  BOEING 	Retail, media, other Disney  TARGET
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5	Industry solutions	<table><tr><td>Healthcare &amp; Life Sciences  TEMPOUS  BABYLON DeepMind</td><td>Finance &amp; Insurance  NUMERA</td><td>Agriculture prosperra BENSON HILL FarmersEdge</td><td>Automotive drive.ai ZOX WAYMO</td><td>Legal &amp; Compliance onfido Luminance casetext ROSS</td><td>Industrials, Robotics &amp; Logistics brain deepvu anli VEKIA LEGILITY</td></tr></table>	Healthcare & Life Sciences  TEMPOUS  BABYLON DeepMind	Finance & Insurance  NUMERA	Agriculture prosperra BENSON HILL FarmersEdge	Automotive drive.ai ZOX WAYMO	Legal & Compliance onfido Luminance casetext ROSS	Industrials, Robotics & Logistics brain deepvu anli VEKIA LEGILITY		
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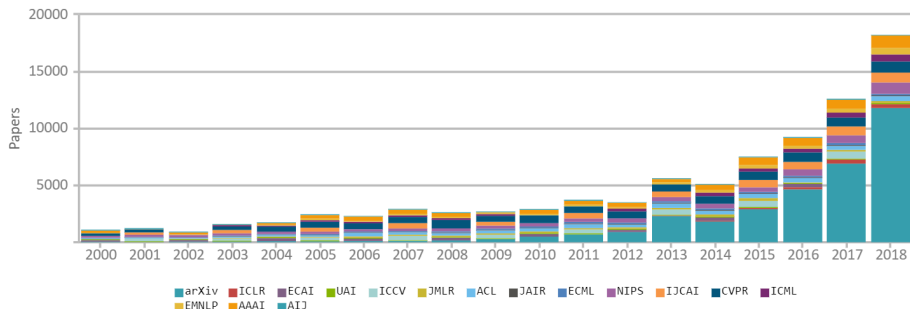
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The number of research papers on AI and Machine Learning has been increasing sharply in the past few years.



<http://aipano.cse.ust.hk/>

Overview of topics: <http://home.cse.ust.hk/~lzhang/topic/ai-tree.pdf>



# Coverage of this Course

Deployment	Adversarial Attack (Security)	XAI (Trust)	Meta-learning (Learn to Learn)	Federated Learning (Privacy)	
	General Issues	Supervised	Self-Supervised	Unsupervised	Reinforcement
<b>Deep Learning</b>	Dropout Normalization Optimizers	Feedforward NN Convolutional NN	Recurrent NN Transformer BERT	VAE GAN	DQN Policy gradient Actor-critic
<b>Machine Learning</b>	Overfitting Bias, variance Regularization Validation	Linear Regression Logistic Regression Generative models SVM		Finite Mixtures	Q-learning
<b>Foundation</b> Principles Algorithms	<b>Probability Theory</b> Likelihood, Bayes theorem		<b>Information Theory</b> Cross entropy Divergence		<b>Optimization Theory</b> Gradient Descent Newton Primal-dual

Objective: Quickly bring students with little background to the forefront of research, while covering all important topics in between.

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