

Artificial Intelligence and Machine Learning

TIMO PENTTILÄ

Artificial Intelligence and Machine Learning

Process Massive Amount of Data

WHY

Zettabyte = trillion gigabytes

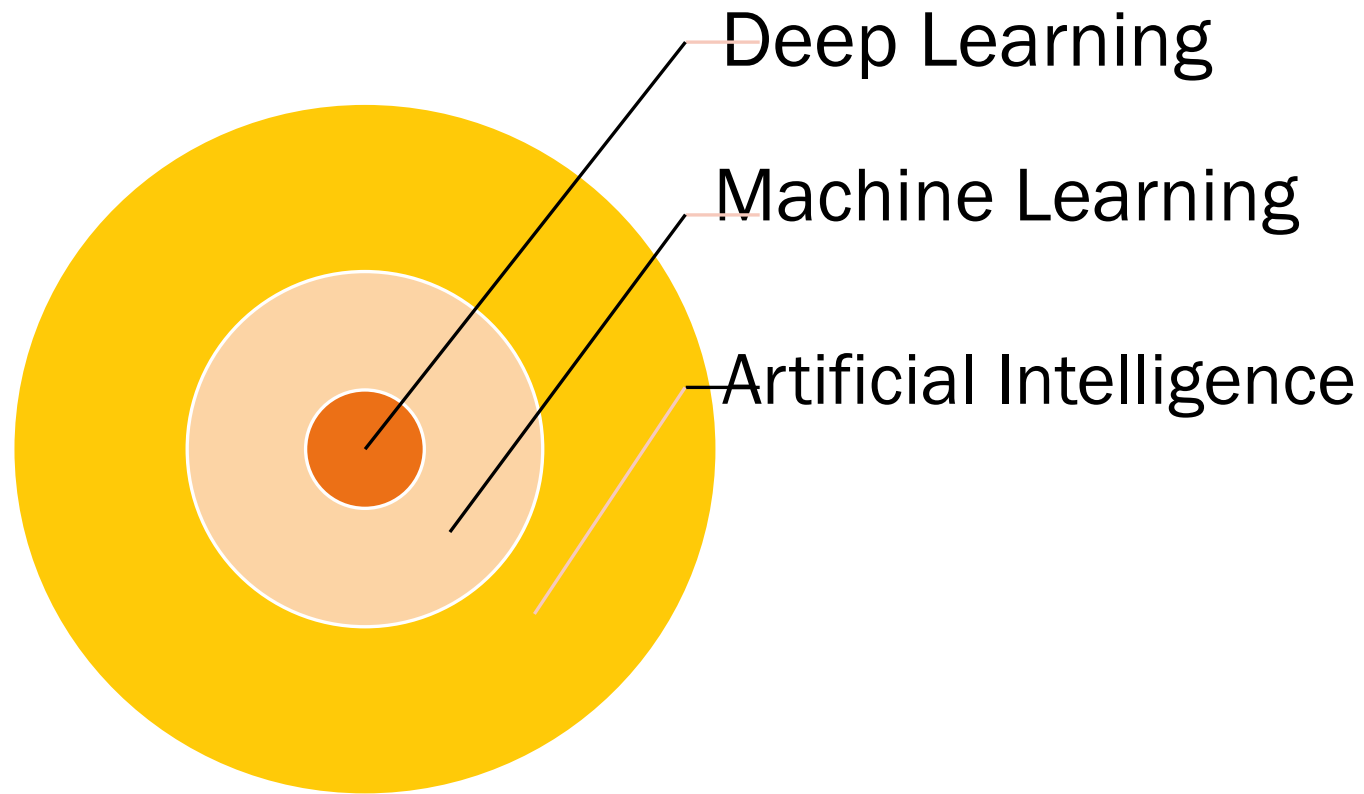
Cost Savings

Removing Human Bias

Computing Power
increased

Avoiding Human errors

Artificial Intelligence and Machine Learning



Artificial Intelligence and Machine Learning and Deep Learning

Artificial Intelligence

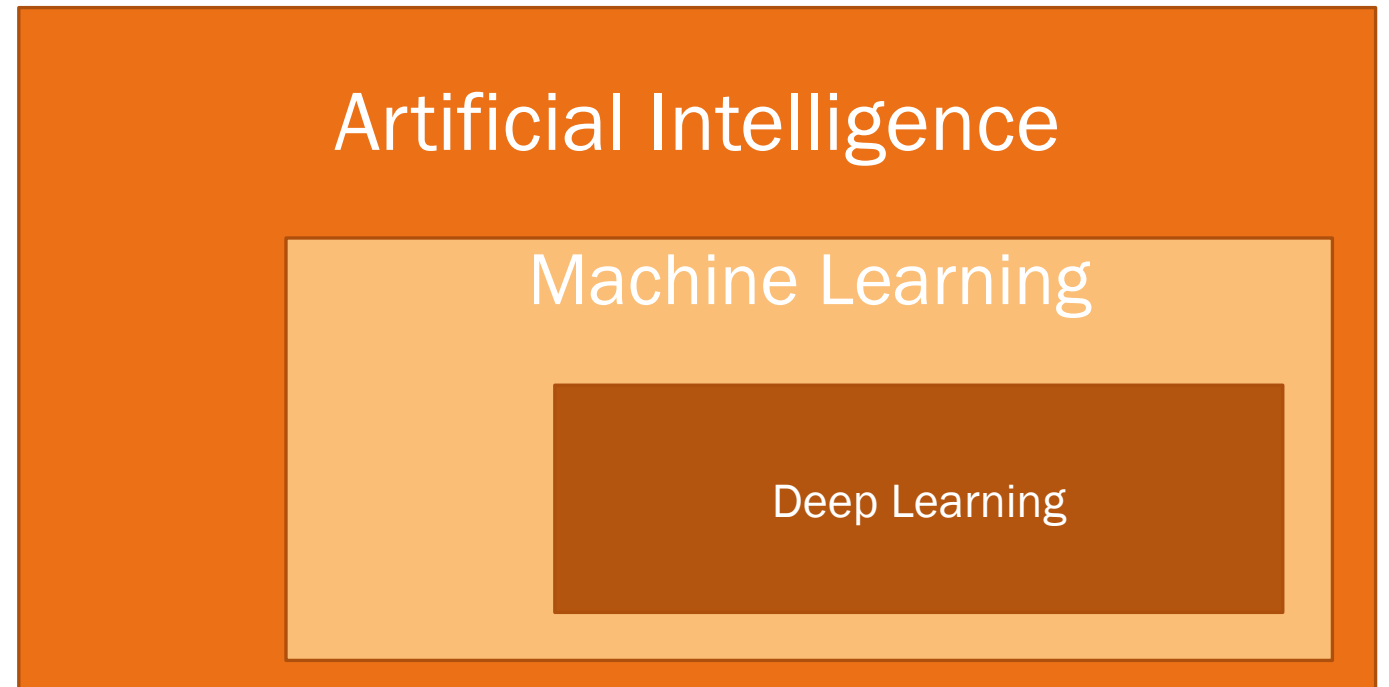
- Mimic Human behaviour/Intelligence
- As simple as “if then else”

Machine Learning

- Machines Improve with Experience

Deep Learning

- ML with Multi-layer Neural Networks



Artificial Intelligence

Broadly, AI describes when a machine mimics cognitive functions that humans associate with other human minds, such as learning and problem solving.

On an even more elementary level, AI can merely be a programmed rule that tells the machine to behave in a specific way in certain situations.

In other words, artificial intelligence can be nothing more than several **if-else** statements.

Not creative

Machine Learning

Machine learning definition: An application of artificial intelligence that includes algorithms that parse data, learn from that data, and then apply what they've learned to make informed decisions.

Machine learning involves a lot of complex math and coding that, at the end of the day, serves the same mechanical function that a flashlight, car, or computer screen does.

Example Spotify, Netflix – recommendations

Methods: decision trees, SVM (support vector machine), Naïve Bayes classifier and logistic regression

Deep Learning

Deep learning definition: A subfield of machine learning that structures algorithms in layers to create an “artificial neural network” that can learn and make intelligent decisions on its own.

A deep learning model is designed to continually analyze data with a logical structure similar to how a human would draw conclusions. To complete this analysis, deep learning applications use a layered structure of algorithms called an **artificial neural network**.

Example of deep learning is Google’s AlphaGo or self-driving cars

[AlphaGo \(deepmind.com\)](https://deepmind.com)

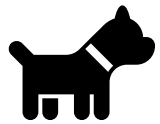
Patterns in
patterns



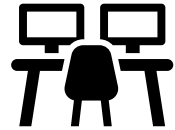
ML vs DL

- Machine learning uses algorithms to parse data, learn from that data, and make informed decisions based on what it has learned.
- ML need some human intervention.
- Deep learning structures algorithms in layers to create an “artificial neural network” that can learn and make intelligent decisions on its own.
- Deep learning is a subset of machine learning. While both fall under the broad category of artificial intelligence, deep learning is what powers the most human-like AI.
- DL need no human intervention

ML vs DL

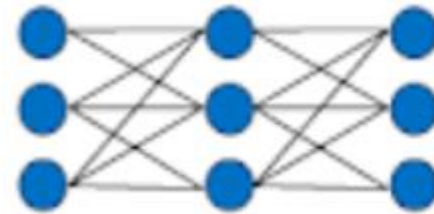


Input / Picture,
Data



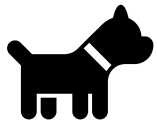
Feature Extraction

Machine Learning



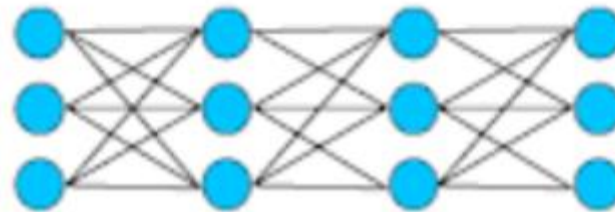
Classification

Output Is
it dog



Input / Picture,
Data

Deap Learning



Feature Extraction and classification

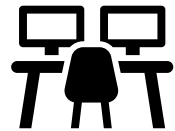
Output Is
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ML vs DL

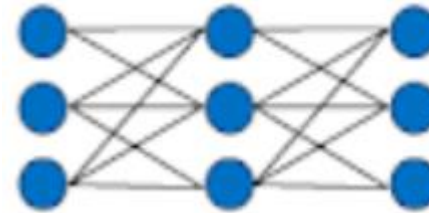
Machine Learning



Input / Picture,
Data



Feature Extraction



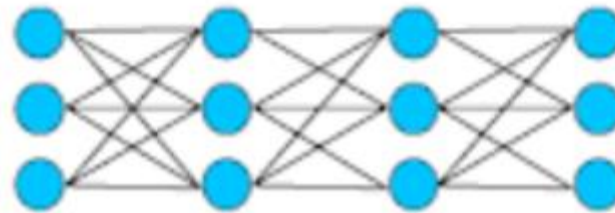
Classification

Output
Buy or
Sell

Deep Learning



Input / Picture,
Data



Feature Extraction and classification

Output
Buy or
Sell

Advantages of Deep Learning

Features are automatically deduced and optimally tuned for desired outcome.

Features are not required to be extracted ahead of time.

Robustness to variations in the data is automatically learned.

The same neural network based approach can be applied different data and applications.

The deep learning architecture is flexible to be adapted to new problems in the future.

Can benefit from large data sets, model will be better the more you have data

Disadvantages on Deep Learning

It requires very large amount of data to perform better than other techniques.

It is expensive to train due to complex data models (often requires GPUs etc. to be used).

There is no standard theory to guide you in selecting right deep learning tools as it requires knowledge of topology, Requires skills to select right models/tools

It is not intuitive, output based on mere learning and requires classifiers to be intuitive.

Natural Language Possessing

Computer Input => Output of Human Language

Natural Language Understanding and Natural Language Reply Generation

Content Generation, Content Summarization, Information Retrieval

Intent Parsing, Sentiment Analysis, Speech Generation,

Speech Recognition and Translation

Chatbots, Voice Assistants

AI, ML and DL applications

Customer Experience (Chatbot, onboarding, risk assessment....)

Regulation and Supervision (AML, Sanction Screening, Insider trading....)

Alpha Generation, Trading - Algorithmic trading, Arbitrage,

Robo Advice

ESG

Underwriting - Credit Scoring

Risk Management

Trading

Fraud detection

Insurance

NLP Applications

Customer Services

Chatbots

Conversational Interfaces

Voice Assistants

Sentiment Analysis (Example BlackRock implemented audio based sentiment analysis)

Voice authentication (Example Vanguard trading desk)

Example customer onboarding

Name

Address and other personal data

- ALM – Sanction Screening – Politically Influenced
- Connectons USA – FATCA (Foreign Account Tax Compliance Act)

Experience in Investments

Wealth

Risk preferences

Example Chapbot – Insurance Claim

lf.fi

File a claim on My Pages

[My Pages](#) are currently available in Finnish and Swedish. You can log into My Pages 24 hours a day using Finnish online banking credentials or a mobile certificate.

What happens next?

The screenshot shows a chatbot interface with two chat windows. The left window is in Finnish, and the right window is in English.

Left Chat Window (Finnish):

- Bot: Vahingon korvattavuus voidaan ratkaista vasta sen jälkeen, kun saamme vahinkoilmoituksen ja mahdolliset pyytämämme lisäselvitykset.
- User: Voit ilmoittaa vahingoista **Omat vahingot** -välilehdellä, tai soittamalla korvauspalveluumme, puh. 010 19 19 19 (ma klo 8-15, ti-pe klo 9-15).
- Bot: Vahinkoilmoitukseen ei voi lisätä liitteitä, pyydämme niitä erikseen tarvittaessa. Otamme ilmoituksesi käsittelyyn ja olemme sinuun yhteydessä mahdollisimman pian.
[ILMOITA VAHINGOSTA](#)
[JÄTÄ SOITTOPYYNTÖ](#)

Right Chat Window (English):

- Header: CAN I FILE A DAMAGE CLAIM
- Bot: Anyone can file a claim. Claims settlement decision will be sent to the policy holder or the insured person.
- User: where can I file claim
- Bot: Home insurance does not cover data, files or programs contained in data carriers. Manuscripts, dissertations, theses and other similar documents are also not included in home insurance.

At the bottom, there is a text input field with the placeholder "[Type your message here]" and a green arrow button to the right.

Example ML based Underwriting

Consumer lending ("pikavippi")

Mortgages

Credit rating

- monthly expenditure decreases

Easy and secure loan process

1. Fill in the application
2. Receive unbound quote
3. Send documents and sign the agreement
4. We will pay the loan into your account

Borrow immediately to an account without collateral

€1,000 to €60,000 in loans for you - whatever you want!

Apply now and you will receive an answer immediately. Our loans and credits are not guaranteed and we do not ask what the money is being spent on.

You will receive a loan offer immediately and the entire application process can be done online by identifying yourself with online banking credentials.

Anti Money Laundering

Anti Money Laundering

- Origin of money
- Transaction monitoring
- Behavior - patterns

Sanction Screening

- Name patterns – similar names (Timo Penttilä, Penttilä Timo. Timo Penttilae,,,,,,,,,,,,)
- Multiple bodies (UN, EU, Police....)
- **Challenge false alerts** (not using date of birth, occupation, address and bank identification codes.....)

Algorithmic High-Frequency Trading

Best execution

Trading large block with minimum impact

Carving out trades systematically to smaller lots

Capitalizing on price discrepancies

First – “Old Time” Trading

Movie: Wallstreet – Gordon Gekko

- Player
- Manipulating market prices slow in human way

Trainee Training trading

- “Fat finger”
- A junior Deutsche Bank employee mistakenly sent \$6 billion to a hedge fund in 2015 after incorrectly entering the “gross figure” instead of net value

Algorithmic High-Frequency Trading

Amplification of Systemic Risk – FLASH CRASH May 2010

- \$1 trillion stock market crash. The crash in value across the major indexes lasted 36 minutes.
- Navinder Singh Sarao – “Spoofing”, placing fake orders and cancelling them
- Place fake orders up and reacting immediately to market movement

Errant Algorithms

- Knight Capital losing 2011 \$440M in 45 minutes
- Buy low sell high or was it **Sell low buy high**

ESG - Sustainability

Sentiment

Tone of the text (read articles, categorize items and extract positive and negative sentiments to produce an array of potential predictive indicators)

Deep dive data and use taxonomy factors

- Industry
- Size
- Location
-
- ESG taxonomy based on Non-Financial Reporting Directive (NFRD) and the Sustainable Finance Disclosure Regulation (SFDR)

Insurance Catastrophe Modelling

Event – example earthquake,

- strength or size, location or path, and probability

Hazard

- Example propagation of seismic energy

Vulnerability

- degree to which structures, their contents, and other insured properties are likely to be damaged

Financial losses for insurer

Challenges

Compliance burden

How regulator reacts – reputational risk – should that be outsourced

Ethics (Google+gmail+android, Apple+phone+siri, Alibaba+Alipay, Klarna....)

Privacy, fairness, discrimination, inclusion

Is ML prohibited

GDPR - Consent for the use of data vs. explaining how data is used

GDPR - Forget the data vs. forget the model and results??

Final Notes

Look Tensorflow for building Machine Learning model from building blocks

Chicago Board of Trade 1995 Deep Learning by human traders / story follows in class

