intel AI

ARTIFICIAL INTELLIGENCE

ICDPPC 2018 Side Event

Digital Data Flows Master Class: Emerging Technologies in Association with Future of Privacy Forum

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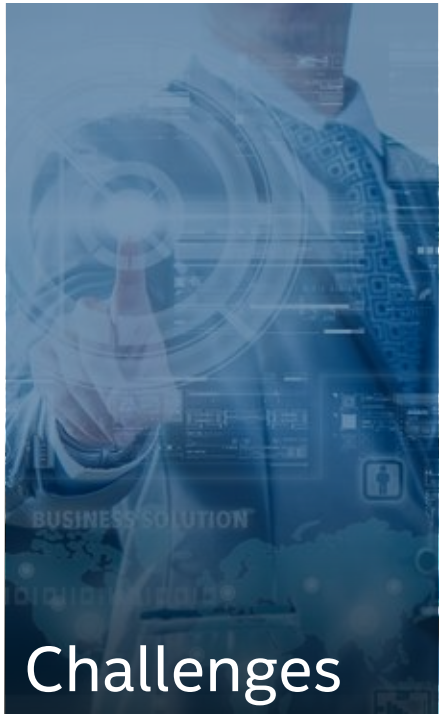
What is AI?

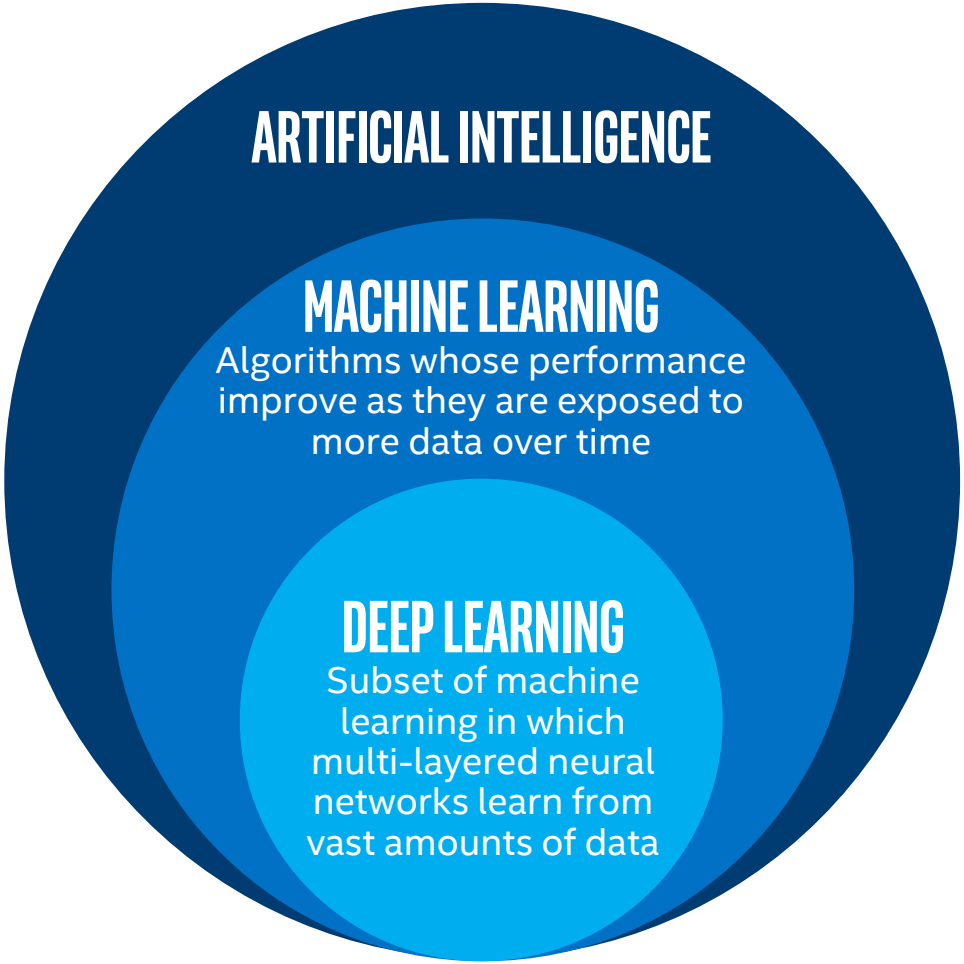

How AI works


Challenges

ARTIFICIAL INTELLIGENCE

.. Is the study of the computations that make it possible to perceive, reason and act. (Winston1992)

.. is the ability of machines to learn from experience, without explicit programming, in order to perform cognitive functions associated with the human mind



AI CLOSER LOOK

MACHINE LEARNING

Algorithms designed to deliver better insight with more data

Regression (Linear/Logistic)

Classification (Support Vector Machines/SVM, Naïve Bayes)

Clustering (Hierarchical, Bayesian, K-Means, DBSCAN)

Decision Trees (RandomForest)

Extrapolation (Hidden Markov Models/HMM)

More...

DEEP LEARNING

Neural networks used to infer meaning from large dense datasets

Image Recognition (Convolutional Neural Networks/CNN, Single-Shot Detector/SSD)

Speech Recognition (Recurrent Neural Network/RNN)

Natural Language Processing (Long-Short Term Memory/LSTM)

Data Generation (Generative Adversarial Networks/GAN)

Recommender System (Multi-Layer Perceptron/MLP)

Time-Series Analysis (LSTM, RNN)

Reinforcement Learning (CNN, RNN)

More...

REASONING

Hybrid of analytics & AI techniques designed to find meaning in diverse datasets

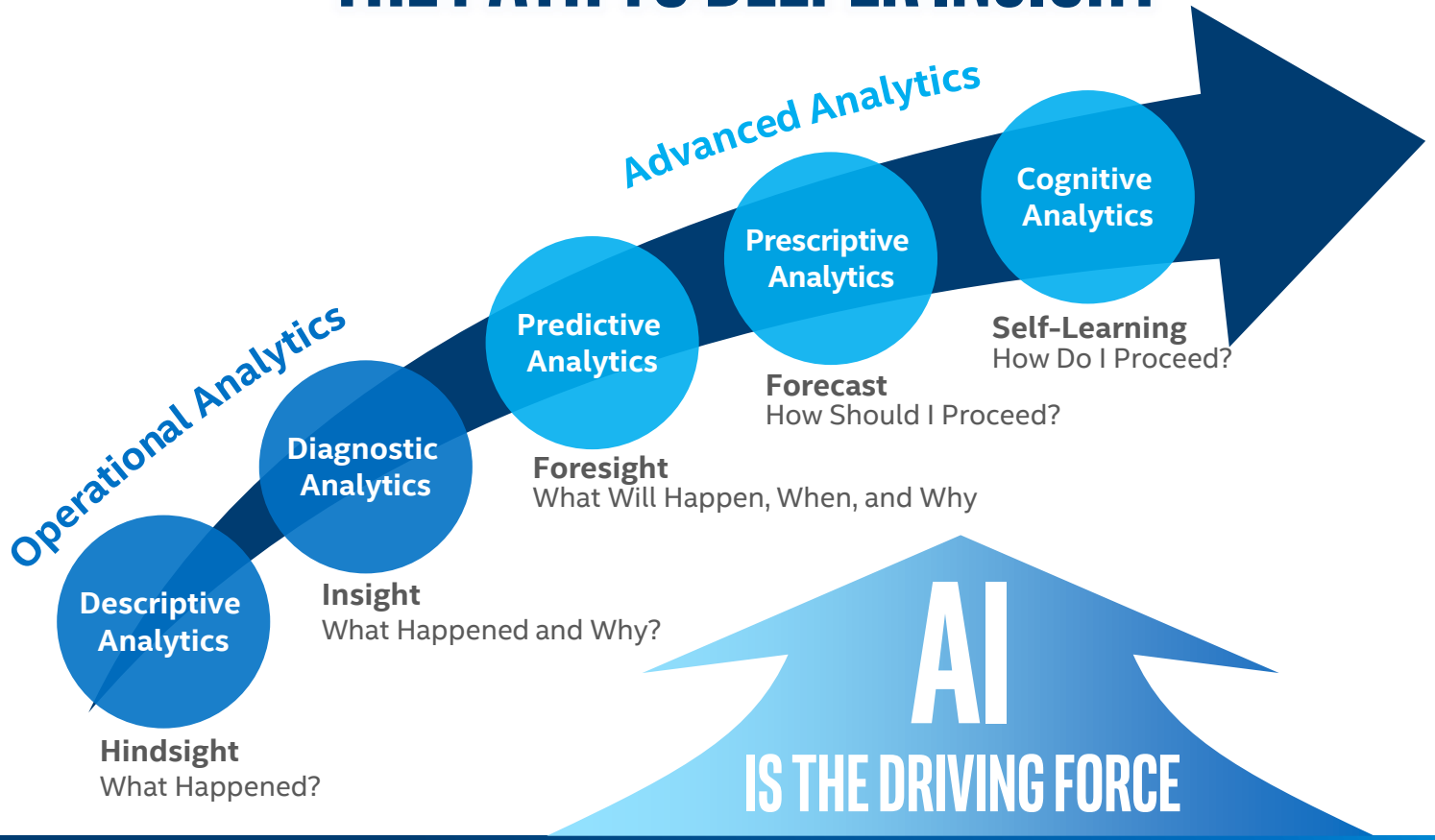
Associative Memory

Rule-based Reasonig (deductive, inductive reasoning)

← **See also:** machine & deep learning techniques

More...

THE PATH TO DEEPER INSIGHT



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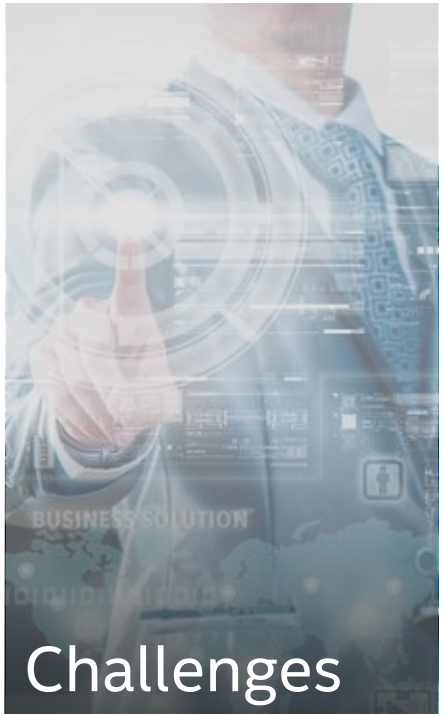
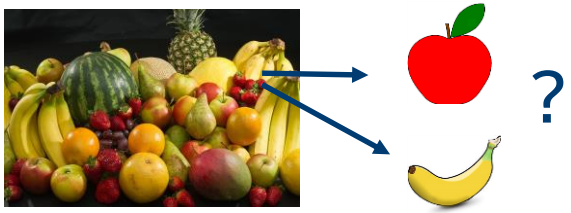
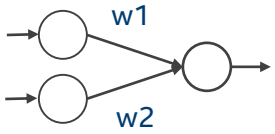


Challenges

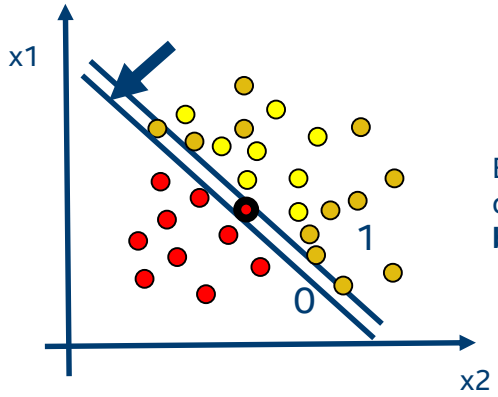
Building block: Classification for decisions making



Linear separator =
Perceptron neural network

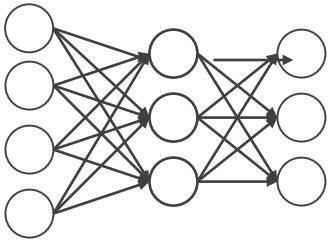


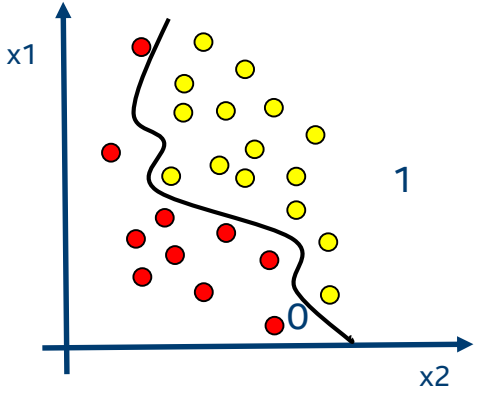
f(a,b)= 1 if x1*w1+x2*w2+b > 0;
0 otherwise



Extension of data-set causes **bias**

Multi-layer neural networks for more complex data distributions





MACHINE VS. DEEP LEARNING

MACHINE LEARNING

How do you engineer the best features?

$N \times N$

$(f_1, f_2, \ldots, f_K)$

Roundness of face
Dist between eyes
Nose width
Eye socket depth
Cheek bone structure
Jaw line length
...etc.

CLASSIFIER ALGORITHM

SVM
Random Forest
Naïve Bayes
Decision Trees
Logistic Regression
Ensemble methods

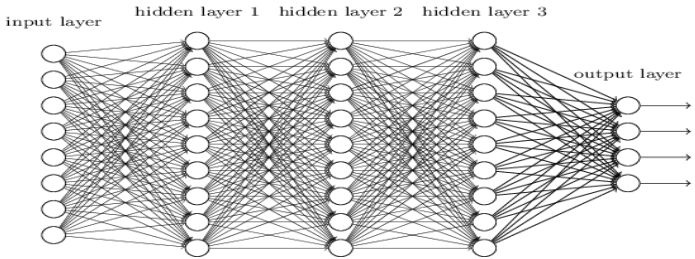
Arjun

DEEP LEARNING

How do you guide the model to find the best features?

$N \times N$

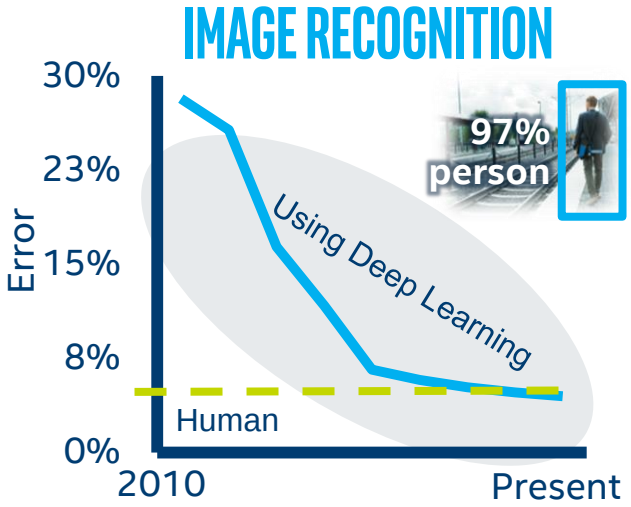
NEURAL NETWORK

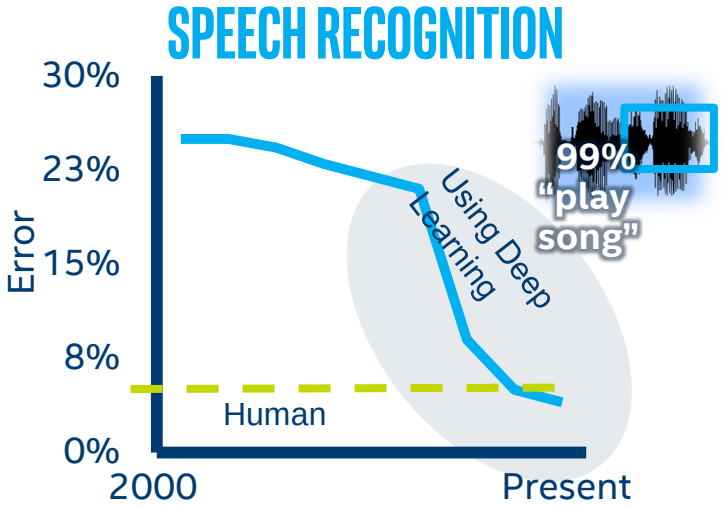


Arjun

DEEP LEARNING BREAKTHROUGHS

Machines able to meet or exceed human image & speech recognition



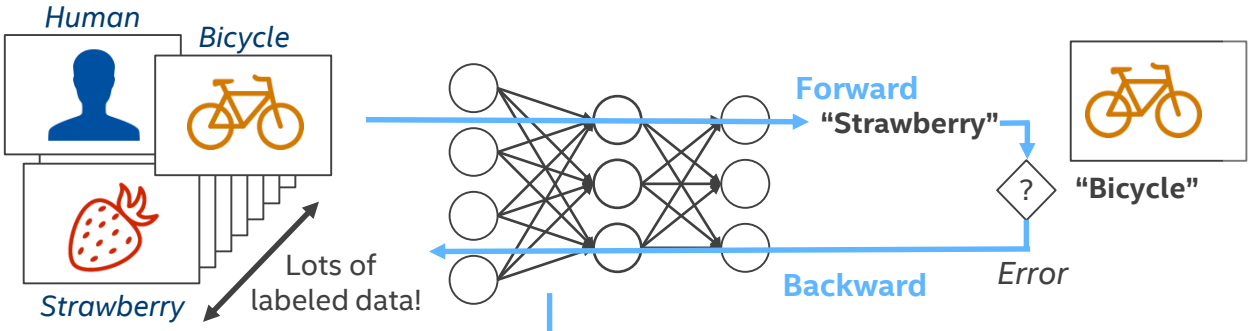


e.g.

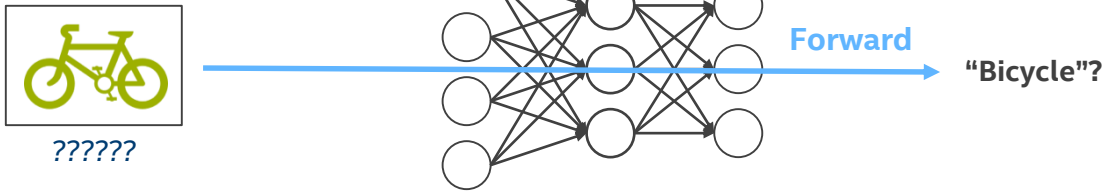
Source: ILSVRC ImageNet winning entry classification error rate each year 2010-2016 (Left), https://www.microsoft.com/en-us/research/blog/microsoft-researchers-achieve-new-conversational-speech-recognition-milestone/ (Right)

DEEP LEARNING BASICS

TRAINING

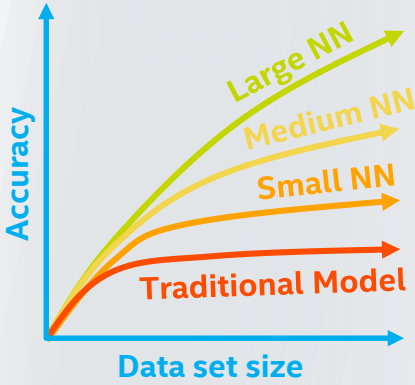


INFERENCE



DID YOU KNOW?

Training with a large data set AND deep (many layered) neural network often leads to the highest accuracy inference



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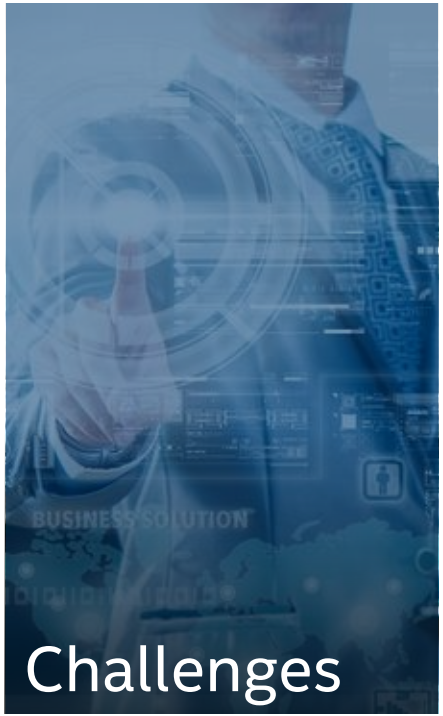
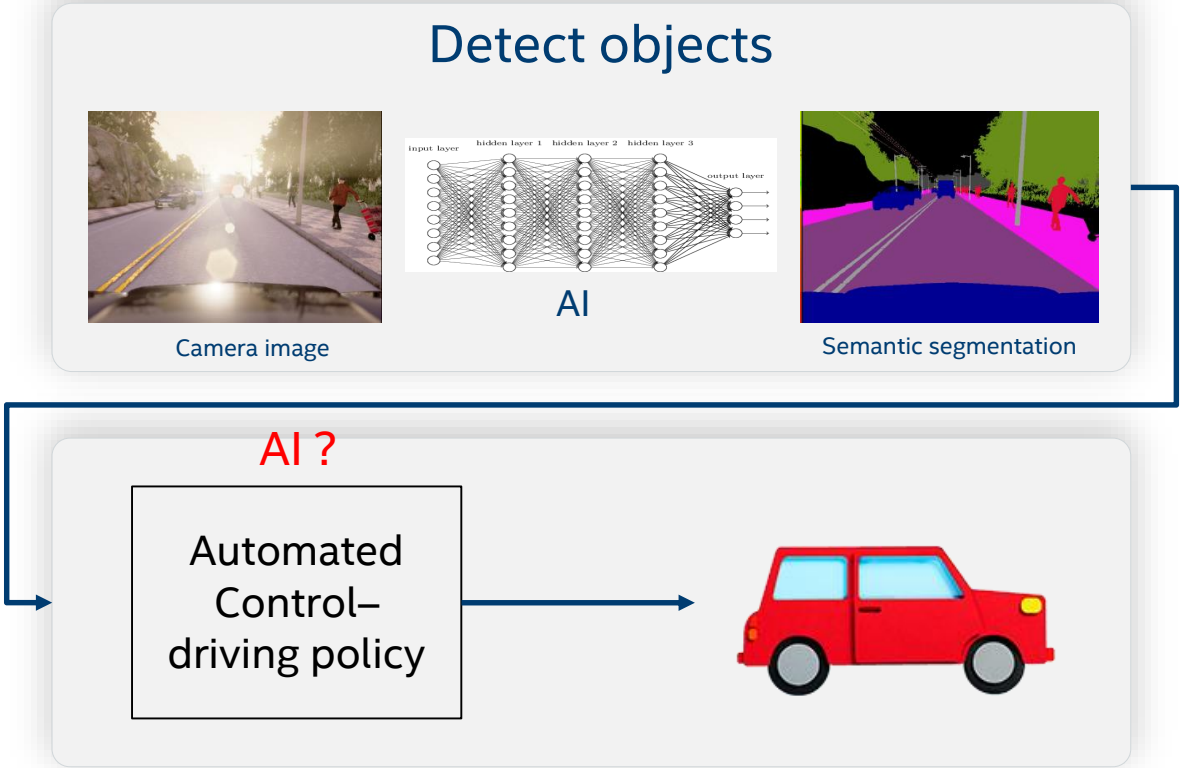


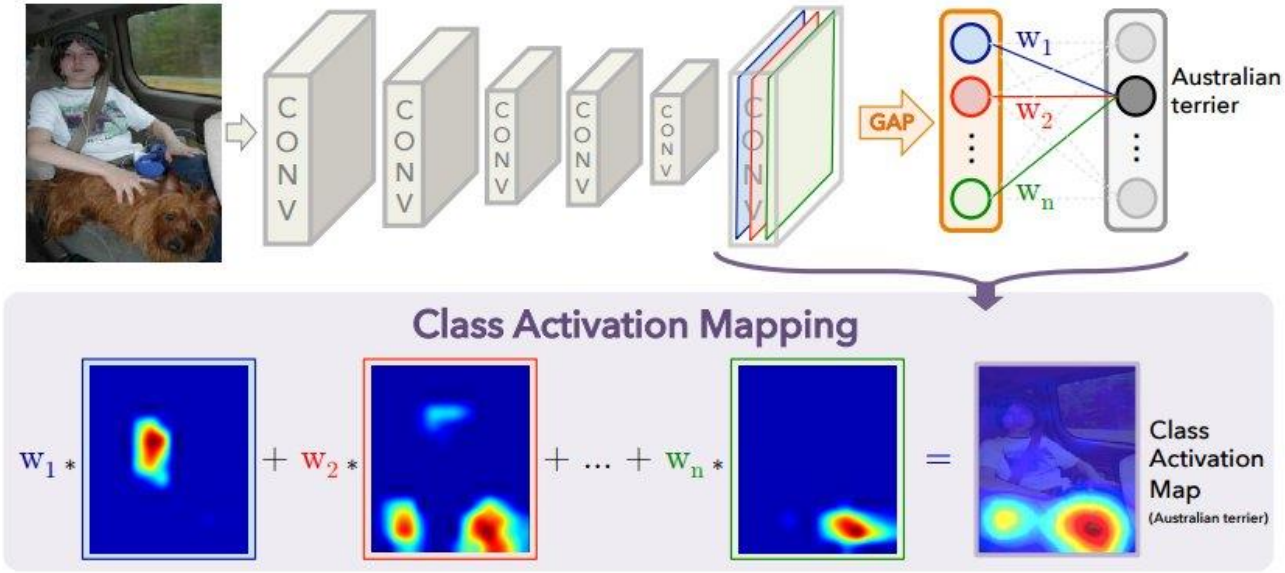
Challenges

Challenges in Automated Driving



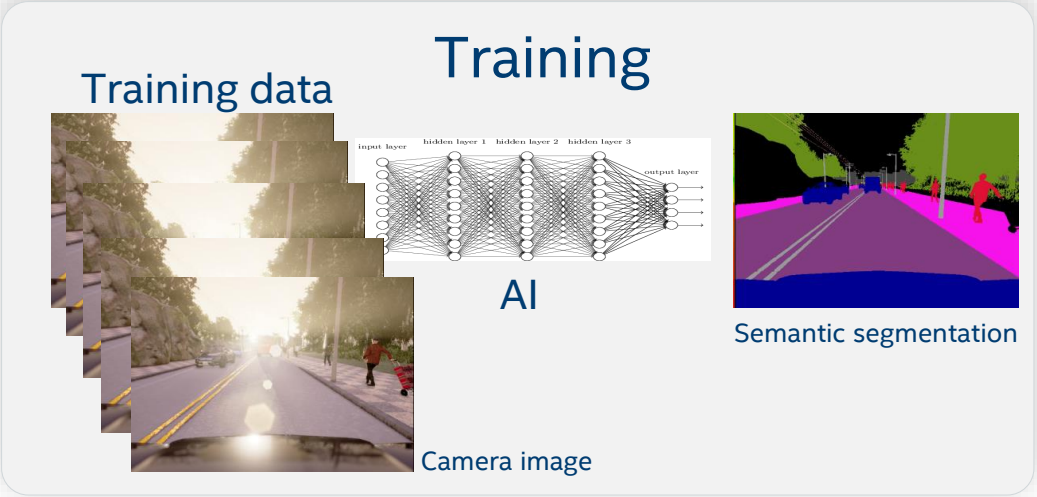
- Biggest question: **Is it safe?**
- Neural networks are not deterministic! **How do they work**?
- Would you learn a driving policy? From whom?

Understanding Deep Networks



Learning Deep Features for Discriminative Localization
Bolei Zhou Aditya Khosla Agata Lapedriza Aude Oliva Antonio Torralba
Massachusetts Institute of Technology

Societal Challenges



- AI need lots of data to work: **Privacy** if data from public required
- **Trust** of AI methods in general because of lack in understanding the underlying principles

Summary

- ML-based AI methods, in particular neural networks rely on training data

\+ perfectly adapt to a task
\+ outperforms many traditional methods
\- problems with biased data
\- lack of explainability

- Societal and commercial challenges
  - Unbiased data
  - Privacy vs. Rich data sets of everything
  - New products must solve: Trust, regulatory obligations, Safety

Further reading

- ACM Europe Technical Policy Committee (was EUACM):
  When Computers Decide: European Recommendations on Machine-Learned Automated Decision Making, Informatics Europe & EUACM, 2018.

Thank you!

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