

## Computer Vision – Deep Learning and AI

Introduction to Deep Learning  
Prof. Dr. Abhinav Valada

## Computer Vision – Deep Learning and AI

Building artificial systems that process,  
perceive, and reason about visual data

## Computer Vision – Deep Learning and AI

Building artificial systems that learn from  
data and experience

## Computer Vision – Deep Learning and AI

Hierarchical learning algorithms with many  
layers, loosely inspired by the brain

## Deep Learning Revolutionized Computer Vision

- Intelligent navigation and localization
- Classification, detection, semantic segmentation

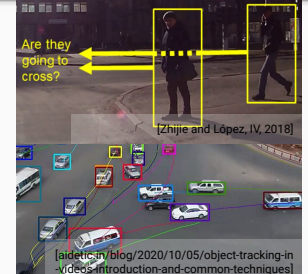


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5

## Deep Learning Revolutionized Computer Vision

- Intelligent navigation and localization
- Classification, detection, semantic segmentation
- Automated pedestrian detection and action prediction
- Obstacle detection and avoidance
- Object tracking

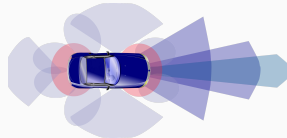


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6

## Deep Learning Revolutionized Computer Vision

- Road traffic sign detection and classification
- Traffic lanes detection
- Autonomous parking
- Multi-sensor data processing and data fusion
- Collision avoidance algorithms
- Perception in challenging conditions



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7

## Deep Learning Revolutionized Computer Vision

Autonomous vehicles and advanced driver-assistance systems:

- Gather and process large amounts of data
- Detailed representation of the surroundings



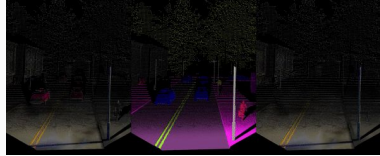
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8

## Deep Learning Revolutionized Computer Vision

Autonomous vehicles and advanced driver-assistance systems:

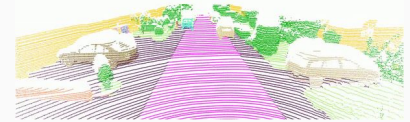
- Gather and process large amounts of data
- Detailed representation of the surroundings
- Better scene understanding



## Deep Learning Revolutionized Computer Vision

Autonomous vehicles and advanced driver-assistance systems:

- Gather and process large amounts of data
- Detailed representation of the surroundings
- Better scene understanding
- Make complex decisions



## Deep Learning Allows Many AI tasks to Converge

- Computer vision
- Robotics
- Speech recognition
- Planning
- Forecasting
- ...



## Module Information

- Introduction to deep learning
- Basic theory
- Learning techniques
- Types of neural networks

## Module Information

- Introduction to deep learning
  - Course overview
  - Overview, history, and challenges for deep learning

## Module Information

- Basic theory
  - Neural networks
  - Activation functions
  - Loss functions
  - Backpropagation
  - Regularization and normalization

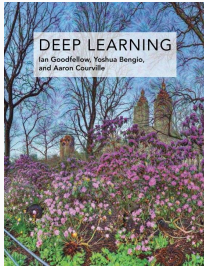
## Module Information

- Learning techniques
  - Supervised learning
  - Datasets
  - Transfer learning
  - Self-supervised and unsupervised learning

## Module Information

- Types of neural networks
  - Introduction to Convolutional Neural Networks (CNNs)
  - Applications of CNNs
  - Introduction to Recurrent Neural Networks (RNNs)
  - Applications of RNNs

## Textbook



- Deep Learning by Goodfellow, Bengio, and Courville
- Free online!

## Logistics

- For background - pre-module reading list
- More advanced/detailed concepts - module reading list
- Questions for yourself at the end of each video
- Please post questions on the course content in the forum

## Reading List

### Some of the latest developments in Deep Learning

MIT machine learning news

<https://news.mit.edu/topic/machine-learning>

Deep learning weekly

<https://www.deeplearningweekly.com/archive>

Deep Learning Book, Chapter 6: detailed discussion of MLPs

<https://www.deeplearningbook.org>

Graphical explanation of a **neural network and activations**

[https://www.youtube.com/watch?v=aircAruvnKk&ab\\_channel=3Blue1Brown](https://www.youtube.com/watch?v=aircAruvnKk&ab_channel=3Blue1Brown)

## Reading List

Graphic representation of the **loss optimization algorithm**

[https://www.youtube.com/watch?v=IHZwWFHw-w&ab\\_channel=3Blue1Brown](https://www.youtube.com/watch?v=IHZwWFHw-w&ab_channel=3Blue1Brown)

**Backpropagation**

[https://www.youtube.com/watch?v=llq3qGewQ5U&ab\\_channel=3Blue1Brown](https://www.youtube.com/watch?v=llq3qGewQ5U&ab_channel=3Blue1Brown)

**Derivatives in computational graphs**

[https://www.youtube.com/watch?v=tleHLnis5U8&ab\\_channel=3Blue1Brown](https://www.youtube.com/watch?v=tleHLnis5U8&ab_channel=3Blue1Brown)

**Transfer Learning and the Importance of Datasets**

<https://www.nxp.com/docs/en/application-note/AN12892.pdf>

**Self-supervised Learning**

[https://www.fast.ai/2020/01/13/self\\_supervised/](https://www.fast.ai/2020/01/13/self_supervised/)