

Computing for Artificial Intelligence and Machine Learning

A hands-on introduction to computing principles and tools relevant to modern machine learning and artificial intelligence.

Who Should Attend

This course is designed for those who are interested in building a foundation of computational thinking with applications to Artificial Intelligence and Machine Learning (AI & ML).

What You Will Learn

- Understanding computer architecture for cache optimization
- Basic programming techniques for AI & ML
- ML tools for data science
- How to build AI projects?

How You Will Benefit

- Build the basic understanding of computer architecture & code optimization "from scratch."
- Learn Python programming and Object-oriented programming.
- Learn ML tools from "scratch" and to use it efficiently
- Acquire skills to build ML and AI projects

Topics:

Programming Foundation: Fundamentals of digital storage of data, Performance of a computer, Caches, Basic optimization techniques for serial codes. Data access optimization.

Introduction to Python: Variables, Conditionals, Notebook, IDE, Lists, Loops, Lists, Strings, Tuples, Sets, Functions, Dictionaries, and Files

Introduction to Object-oriented programming: Object and Data Structure Basics, Python Statements, Methods and Functions, Object-oriented programming (OOP): Inheritance, Encapsulation, Abstraction, Polymorphism. OOP concepts in Python. OOP concepts in C++. Introduction to Algorithms.

Data Science tools: Pandas, NumPy, Matplotlib, Scikit-Learn, Just-in-Time (JIT) compilers, Numba. Data Story and Google Data Studio,

Machine Learning: Data Munging, Linear Regression, Linear Classification, Multilayer Perceptron, Backpropagation, Automatic Differentiation, Artificial Neural Network, Hyperparameter selection, Federated Learning, Dashboard

Deep Learning with Open source AI/ML Packages: Tensors, TensorFlow basics, Scikit-Learn, Simple statistics and plotting, Loading and exploring data, Learning with TensorFlow and Keras, Mini-project.

Introduction to AI: What is AI? Building AI Projects. Building AI in a company, Recent advances in ML

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Date	Lecture	Topics	Concepts
Week 1:			
3 August 2022	Lect. 1	Introduction to Data Science	Working definition in AI/ML, Data Science tools, Components in Data Science
Week 2:			
10/08/2022	Lect. 2	Fundamentals of digital storage of data	Bits, bytes, and represent of numbers and data in computer Errors in data representation in computers Computer Architecture development: History and recent trends
Week 3:			
17/08/2022	Lect. 3	Computer Architecture	Classification of computers SMP, DMP, Hybrid computer architectures
Week 4:			
22/08/2022	Lect. 4	Cache Optimization	Computer Architecture - Recap, Basics of Memory Hierarchies, Cache Optimizations Techniques
24/08/2022	Lect. 5	Cache Optimization	Prefetching of instructions and data, Further Reading on Cache Optimization, Roofline model
Week 5			
29/08/2022	Lect. 6	Python Programming	Installing Python, Basic data types, Statements, loops, functions
Week 6			
05/09/2022	Lect. 7	OOP in Python and C++	Object, Class, Inheritance, Polymorphism, Abstraction, Encapsulation,
07/09/2022	Lect. 8	Introduction to Algorithms	Common algorithms, algorithmic paradigms, basic performance measures and analysis techniques
Week 7			
12/09/2022	Lect. 9	Tools for Machine Learning	Numpy, Matplotlib
14/09/2022	Lect. 10	Tools for Machine Learning	Pandas and Seaborn
Week 8			
19/09/2022	Lect. 11	Dashboard	Data Story and Google Data Studio
21/09/2022	Project	Group project presentation by the participants	
Week 9			
26/09/2022	Midterm Exam		
28/09/2022	Lect. 13	Machine Learning Methods	Polynomial Regression, Logistic regression, Regularization (Ridge / Lasso)
Week 10			
03/10/2022	Lect. 14	Machine Learning Methods	Artificial Neural Networks, Backpropagation
Week 11			
10/10/2022	Lect. 15	Machine Learning Methods	Design of Deep learning Systems
12/10/2022	Lect. 16	Machine Learning Methods	Modeling aspects of ANN, Hyperparameter selection
Week 12			
17/10/2022	Lect. 17	Softwares for ML	Tensorflow, SciKit-Learn
19/10/2022	Lect. 18	What is AI?	
Week 13			

26/10/2022	Lect. 19	Building AI Projects	Workflow in ML, How to choose an AI project?
Week 14			
31/10/2022	Lect. 20	AI Projects in companies	AI case studies
02/11/2022	Lect. 21	AI Projects in companies	AI case studies
Week 15			
07/11/2022	Lect. 22	AI and Society	AI and developing economies, AI and jobs
09/11/2022	Lect. 23	Recent advances in ML	Federated learning, ML on Edge
Week 16			
14/11/2022	Lect. 24	Recent advances in ML	MLOps at scale
16/11/2022	Project	Group project presentation by the participants	
21/11/2022	Final Exam		
Textbook			
<p>1. John Hennessy David Patterson. Computer Architecture. A Quantitative Approach. 6th edition, Morgan Kauffman, 2017. https://www.elsevier.com/books/computer-architecture/hennessy/ 978-0-12-811905-1</p> <p>2. Shaw, Zed A. Learn python 3 the hard way: A very simple introduction to the terrifyingly beautiful world of computers and code. Addison-Wesley Professional, 2017</p> <p>3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media, Inc. 2019</p>			
	Item		
	Tutorial Timings	Friday : 6 pm - 7 pm	
	Quiz Timings	Friday : 6 pm - 7 pm	
	Midterm Exam	23/09/2022	
	Final Exam	21/11/2022	