Foundations of Machine Learning

Target Audience: Students and Professionals Preparing for ML

Why This Course?

Machine Learning requires more than just coding skills—it demands a strong foundation in **mathematics, algorithms, and programming**. Many learners struggle with ML not because the concepts are too advanced, but because they lack the **mathematical intuition or coding fluency** needed to implement and understand the models.

This course bridges that gap. By combining **Python programming** with **essential mathematics for ML**, you will build the skills necessary to transition confidently into advanced machine learning.

By the end of this course, you will:

- Strengthen your Python skills for mathematical and algorithmic problem-solving.
- Gain mastery of the core math topics essential for ML.
- Implement mathematical concepts in Python through **coding exercises and projects**.
- Use **Git and GitHub** to manage and showcase your work.
- Be fully prepared to take on advanced ML algorithms and techniques.

What Will You Learn?

1. **Python Foundations for Math and ML**
   - Python programming for scientific computing.
   - Explore essential libraries: NumPy, Pandas, and matplotlib.
   - Work with Jupyter notebooks for experimenting with math and algorithms.
2. **Mathematical Foundations**
   - Linear Algebra: Vectors, matrices, operations, eigenvalues, and eigenvectors.
   - Probability & Statistics: Random variables, distributions, expectation, variance, hypothesis testing.
   - Calculus & Optimization: Derivatives, gradients, and the foundations of optimization methods.
3. **Algorithms for ML Preparation**
   - Implementation of classical algorithms in Python.
   - Time and space complexity (Big-O analysis).
   - Numerical methods relevant for ML.
4. **Optimization Methods**
   - Gradient descent: intuition, mathematics, and implementation.
   - Variants of gradient descent (stochastic, mini-batch).
   - Convergence, pitfalls, and practical considerations.
5. **Programming Practice & Projects**
   - Extensive hands-on coding throughout the course.

- Mini-projects to reinforce each major concept.
- Application-focused exercises linking math to ML.

6. **Git & Version Control**
   - Introduction to Git and GitHub.
   - Tracking changes, branching, and collaborative coding.
   - Building a GitHub portfolio of your projects.
7. **Additional Concepts as Needed**
   - Entropy and Information Gain (for decision trees).
   - Distance and Similarity Metrics (for kNN and clustering).
   - Log-Likelihood and Expectation (for probabilistic models).
   - Matrix Factorization and Eigen Decomposition (for dimensionality reduction).

Course Differentiators

- **24-week intensive program** combining depth and hands-on practice.
- Integrated approach combining **Python coding with mathematical rigor.**
- Heavy emphasis on **programming, projects, and practical problem-solving.**
- Git and GitHub usage throughout to instill **industry-ready practices**.
- Designed as a **bridge course** to prepare you for ML.

Course Benefits

- Build the **core math intuition** required for AI and ML.
- Develop **problem-solving skills** that connect theory to practice.
- Gain confidence by completing **mini-projects** and maintaining a GitHub portfolio.
- Be **ML-ready** by the end of the course, with a solid foundation to tackle advanced topics.

Who Should Enroll?

- Students aiming to pursue ML or AI.
- Professionals looking to strengthen their math and coding foundations.
- Learners who want to confidently bridge the gap between Python programming and ML.

Course Duration: 24 weeks
Mode: Online
Instructor Support: Live sessions and Q&A opportunities

Get ML-Ready with Python and Math

This course gives you the tools to **connect coding, math, and algorithms**, setting you up for success in advanced machine learning.