

AI102

Mathematical Foundations for Data Science and AI

Dr. Khaled ELMenshawy

Introductory Lecture



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Mathematics plays an important role as it builds the foundation for programming for data science.

In this course, I will help you master the mathematical foundation required for writing programs and algorithms for AI and ML.



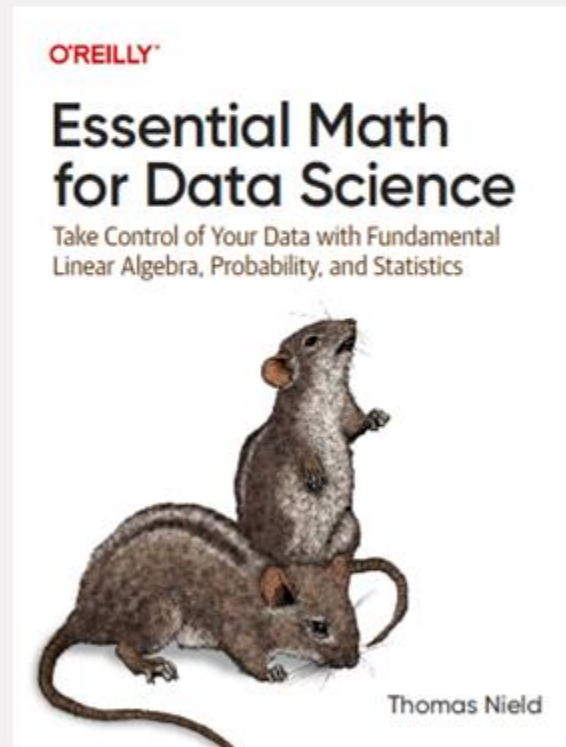
A Data Scientist's primary role is to mine, examine, and make sense of data. Mathematics plays a great role in each of these stages. Data Scientists use mathematics to:

- Understand and use machine learning algorithms.
- Perform data analysis.
- Identify patterns in data.

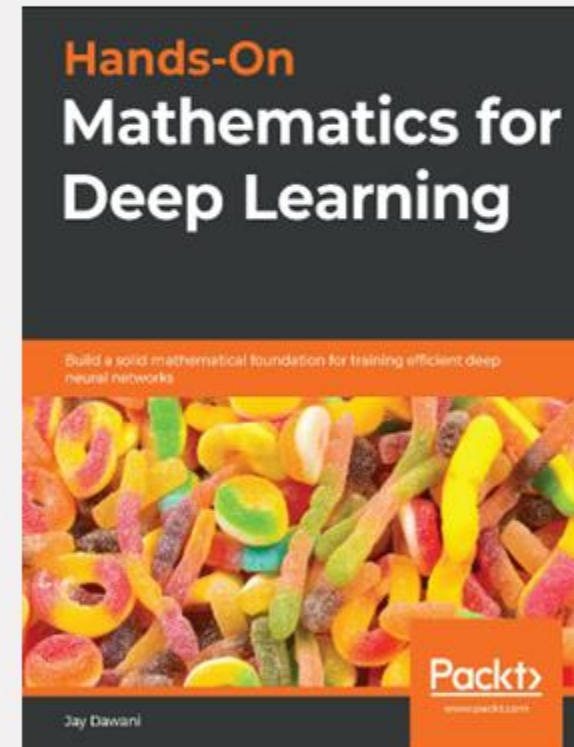
Data Scientists also use math to perform data analysis and machine learning techniques like clustering, regression, and classification.

References

Required Textbook



Additional Textbook



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Linear Algebra

- Linear Algebra the mathematics of data and the foundation of machine learning. Data Scientists manipulate and analyze raw data through matrices, Datasets usually take the form of matrices. Data Scientists store and manipulate data inside them and they use linear algebra during the process.
- At a minimum, Data Scientists should know Matrices and Vectors and how to apply linear algebra principles to solve data problems.



Calculus

- Data science fields require comprehension of fundamental calculus principles and their effect on machine learning models.
- Some calculus concepts that Data Scientists may use:
 - **Gradient descent** - an optimization algorithm that trains machine learning models to learn over time and become more accurate
 - **Multivariable calculus** - machine learning uses multivariable calculus to build predictive models.



Statistics

- Statistics is the most important math for data science. It collects and analyzes large data sets to interpret meaningful insights from them. Naturally, almost every aspect of data science uses statistics.:
 - Descriptive Statistics
 - Inferential Statistics
 - Hypothesis Testing



Probability

- Making predictions is a large part of data science, thus Data Science needs to know these basics of probability:
 - Distributions
 - Bayes' Theorem



Thank You



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