KOENIG SOLUTIONS · COURSE OUTLINE

Dimensionality Reduction: Advanced Techniques

Start your Dimensionality Reduction journey today

3 Days	10	51
24 HOURS	MODULES	TOPICS

COURSE OVERVIEW

This course is designed to provide practical examples and hands-on exercises to reinforce the concepts. Additionally, encourage students to work on a mini-project or real datasets to gain practical experience in dimension Reduction.

WHO THIS COURSE IS FOR

Data Scientists | **Machine Learning Engineers** | **Data Analysts** | **AI Researchers** | **Big Data Engineers**

LEARNING OBJECTIVES

- Explain why dimensionality reduction is needed and its challenges
- Apply PCA using variance, covariance and eigenvectors
- Implement PCA in Python and choose the number of components
- Compare t-SNE, UMAP and PCA for visualisation and use cases
- Apply Linear Discriminant Analysis and contrast it with PCA
- Implement NMF for topic modelling and image processing
- Build autoencoders and variational autoencoders for anomaly detection
- Assess feature selection methods alongside kernel PCA for big data

COURSE SYLLABUS

10 Modules, 51 Topics

01

Introduction to Dimensionality Reduction

TOPICS

- What is Dimensionality Reduction?
- Why is Dimensionality Reduction required?
- Importance in Machine Learning
- Curse of Dimensionality
- Common Dimensionality Reduction Techniques
- Principal Component Analysis (PCA) - An Overview
- Curse of Dimensionality - Risk of Overfitting
- Problem of Multicollinearity, lead to Overfitting
- Dimensionality reduction reduces dimension and not loose any information

DEFINITION, TYPE OF DIMENSIONALITY REDUCTION TECHNIQUE

- PCA
- LDA
- T-sne

CORRELATION - STRENGTH AND RELATIONSHIP BETWEEN TWO VARIABLES

- Spearman Correlation
- Pearson Correlation
- Collinearity & Multi Collinearity
- Technique to check collinearity : VIF

02

Principal Component Analysis (PCA)

TOPICS

PCA Algorithm and Intuition · Variance and Covariance · Eigenvalues and Eigenvectors · Implementing PCA in Python

03

Practical Implementation of PCA

TOPICS

Choosing the Number of Principal Components · Reducing Data with PCA · PCA for Visualization · Applications in Real-world Datasets

04

Alternative Techniques - t-SNE and UMAP

TOPICS

- t-Distributed Stochastic Neighbor Embedding (t-SNE)
- Uniform Manifold Approximation and Projection (UMAP)
- Comparing PCA, t-SNE, and UMAP
- Use Cases and Limitations

05

Linear Discriminant Analysis (LDA)

TOPICS

Introduction to LDA · Within-class and Between-class Scatter · Solving the Eigenvalue Problem · LDA vs. PCA

06

Non-negative Matrix Factorization (NMF)

TOPICS

Introduction to NMF · Multiplicative Update Rule · NMF for Topic Modeling and Image Processing · NMF in Scikit-Learn

07

Autoencoders for Dimension Reduction

TOPICS

Introduction to Autoencoders · Encoder and Decoder Networks · Variational Autoencoders (VAE) · Applications in Anomaly Detection

08

Kernel PCA and Feature Selection

TOPICS

- Kernel Principal Component Analysis (Kernel PCA)
- Feature Selection vs. Dimensionality Reduction
- Wrapper and Filter Methods
- Embedded Methods for Feature Selection

09

Dimensionality Reduction for Big Data

TOPICS

- Challenges of Dimension Reduction with Big Data
- Random Projections and Sparse Techniques
- Incremental PCA and Mini-batch PCA
- Spark MLlib for Large-scale Data

10

Use Cases and Advanced Topics

TOPICS

- Dimension Reduction in Natural Language Processing (NLP)
- Genomic Data Dimensionality Reduction
- Visualization Tools for High-dimensional Data

WHAT IS INCLUDED

Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

ABOUT KOENIG

Who We Are

Established in 1993, Koenig Solutions is a globally recognised training provider with 35+ technology partnerships, 5,000+ training programmes and a network of certified instructors and subject matter experts, supporting individuals and enterprise teams worldwide.

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