Robust Statistics for Outlier Detection Training Course

Professional Development Training Course Outline

Category	Research and Data Analysis	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In today’s data-driven world, accurate data analysis is crucial for making strategic decisions across industries. However, outliers and anomalies can significantly distort insights, leading to costly mistakes. Robust Statistics for Outlier Detection Training Course is designed to equip data professionals, analysts, and decision-makers with advanced statistical techniques to identify, analyze, and manage outliers effectively. Leveraging robust statistical methods, this course ensures that participants gain hands-on expertise in handling noisy datasets, high-dimensional data, and real-world anomalies, enhancing the reliability and accuracy of their data-driven decisions.

This comprehensive training combines theoretical knowledge with practical applications, covering key methods such as robust regression, Mahalanobis distance, boxplot-based detection, and machine learning integrated approaches. Participants will explore case studies from finance, healthcare, manufacturing, and cybersecurity, applying advanced outlier detection techniques to solve real-world problems. By the end of this program, learners will be equipped with actionable skills to improve data quality, risk assessment, and predictive analytics, empowering organizations to make confident, evidence-based decisions.

Programme Curriculum

Robust Statistics for Outlier Detection Training Course

Introduction

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Course Duration

10 days

Course Objectives

Participants will be able to:

1. Understand the fundamentals of robust statistics for reliable outlier detection.
2. Apply advanced outlier detection techniques in real-world datasets.
3. Detect anomalies using robust regression methods.
4. Utilize Mahalanobis distance and robust covariance estimators for multivariate outlier detection.
5. Implement boxplot, IQR, and percentile-based techniques for univariate anomaly detection.
6. Integrate machine learning algorithms for anomaly detection.
7. Manage high-dimensional and complex datasets effectively.
8. Conduct time-series anomaly detection using robust methods.
9. Apply robust PCA and dimensionality reduction techniques.
10. Enhance data preprocessing and cleaning workflows.
11. Use visualization tools for identifying patterns and outliers.
12. Interpret and communicate statistical findings to non-technical stakeholders.
13. Solve industry-specific case studies in finance, healthcare, manufacturing, and cybersecurity.

Target Audience

1. Data Scientists
2. Data Analysts
3. Business Intelligence Professionals
4. Statisticians
5. Risk Analysts
6. Machine Learning Engineers
7. Quality Control and Manufacturing Professionals
8. Healthcare Data Professionals

Course Modules

Module 1: Introduction to Robust Statistics

- Definition and importance of robust statistics
- Difference between classical and robust methods
- Influence of outliers on statistical models
- Key robust estimators overview

- Case Study: Impact of outliers in healthcare patient data

Module 2: Understanding Outliers

- Types of outliers
- Causes of outliers in datasets
- Outlier impact on data analytics
- Detection and treatment of outliers
- Case Study: Financial fraud detection

Module 3: Univariate Outlier Detection

- Boxplot and IQR method
- Percentile-based detection
- Z-score limitations
- Winsorization techniques
- Case Study: Manufacturing quality control data

Module 4: Multivariate Outlier Detection

- Mahalanobis distance
- Robust covariance estimators
- Scatterplot and ellipse method
- Cluster-based detection
- Case Study: Customer segmentation in retail

Module 5: Robust Regression Techniques

- Least trimmed squares (LTS)
- M-estimators
- RANSAC method
- Handling leverage points
- Case Study: Predicting sales with anomalous data

Module 6: High-Dimensional Data Analysis

- Curse of dimensionality
- Robust PCA
- Feature selection for anomaly detection
- Subspace outlier detection
- Case Study: Genomic data anomalies

Module 7: Time-Series Anomaly Detection

- Statistical control charts
- Seasonal and trend analysis
- Moving average and smoothing techniques
- Detecting spikes and dips
- Case Study: Sensor data from IoT devices

Module 8: Machine Learning for Outlier Detection

- Isolation Forest

- One-Class SVM
- Autoencoders for anomaly detection
- Model evaluation metrics
- Case Study: Credit card fraud detection

Module 9: Data Preprocessing and Cleaning

- Handling missing values
- Data normalization and transformation
- Detecting duplicates
- Outlier treatment strategies
- Case Study: Healthcare EHR data

Module 10: Visualization for Outlier Detection

- Scatter plots, boxplots, and violin plots
- Heatmaps and correlation matrices
- Dimensionality reduction visualizations
- Interactive dashboards for anomaly monitoring
- Case Study: Telecom churn analysis

Module 11: Robust Statistical Software Tools

- R and Python packages
- MATLAB and SAS applications
- Implementation best practices
- Automation for large datasets
- Case Study: Stock market anomaly detection

Module 12: Industry-Specific Applications

- Finance and fraud detection
- Healthcare and patient monitoring
- Manufacturing and quality assurance
- Cybersecurity and intrusion detection
- Case Study: Multi-industry application comparison

Module 13: Outlier Detection Metrics

- Precision, recall, F1-score
- ROC and AUC for anomaly detection
- Sensitivity to contamination
- Choosing the right metric for the problem
- Case Study: Evaluating anomaly detection in banking

Module 14: Advanced Techniques in Robust Statistics

- Robust clustering
- Robust covariance and correlation
- Huber and Tukey methods
- Hybrid statistical approaches
- Case Study: Insurance claim anomaly analysis

Module 15: Project-Based Hands-On Lab

- Full dataset anomaly detection
- Applying robust statistical methods
- Generating actionable insights
- Presenting results to stakeholders
- Case Study: Real-world corporate project

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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