Training Course on Survival Analysis and Event Prediction

Professional Development Training Course Outline

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

Course Introduction

Survival Analysis, often referred to as **time-to-event analysis**, is a powerful statistical methodology specifically designed to model and predict the duration until a defined event occurs. This crucial field extends beyond traditional regression techniques by effectively handling **censored data** – a common challenge where the event of interest has not yet occurred for all subjects by the end of the observation period. From clinical trials predicting patient outcomes to engineering reliability forecasting component failures, and from customer churn prediction in business to analyzing time-to-default in finance, survival analysis provides unparalleled insights into dynamic processes over time, enabling proactive decision-making and strategic interventions across diverse industries.

Training Course on Survival Analysis & Event Prediction delves into the theoretical foundations and practical applications of Survival Analysis and Event Prediction. Participants will gain hands-on experience with cutting-edge statistical models and computational tools, equipping them with the expertise to analyze complex **longitudinal data**, identify key risk factors, and build robust predictive models. Through practical exercises and real-world **case studies**, attendees will master the art of extracting actionable insights from time-to-event data, transforming raw information into strategic intelligence for enhanced **organizational performance** and **risk management**.

Programme Curriculum

Training Course on Survival Analysis & Event Prediction: Modeling Time-to-Event Data

Introduction

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Course Duration

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Course Objectives

1. Comprehend the unique characteristics of time-to-event data, including censoring and truncation.
2. proficiently calculate and interpret Kaplan-Meier survival curves for descriptive analysis and group comparisons.
3. Effectively use the Log-Rank Test to compare survival distributions across different cohorts.
4. Develop and interpret the Cox Proportional Hazards (PH) regression model for multivariate survival analysis.
5. Learn to validate and address violations of the proportional hazards assumption in Cox models.
6. Understand and apply various parametric survival distributions (e.g., Weibull, Exponential, Log-Normal) for specific data characteristics.
7. Master techniques for handling competing risks scenarios where multiple event types can occur.
8. Model the impact of time-dependent covariates on event hazards.
9. Utilize survival models for event prediction and forecasting future event occurrences.
10. Assess the predictive accuracy and goodness-of-fit of survival models using metrics like Concordance Index (C-index) and AIC/BIC.
11. Gain practical skills in implementing survival analysis techniques using popular R and Python statistical libraries.
12. Translate complex statistical outputs into clear, actionable insights for business intelligence and strategic decision-making.
13. Apply advanced survival analysis methods to solve practical problems in healthcare analytics, customer lifetime value (CLV), predictive maintenance, and credit risk modeling.

Organizational Benefits

- Develop more precise forecasts for critical events like customer churn, equipment failure, or patient outcomes, leading to better resource allocation and proactive interventions.
- Identify and quantify risk factors more effectively, enabling organizations to mitigate potential losses and make more informed risk-based decisions.
- Predict when events are likely to occur, allowing for optimized scheduling of maintenance, targeted marketing campaigns, and efficient clinical trial design.

- Understand customer longevity and churn drivers, leading to improved customer retention strategies and increased customer lifetime value (CLV).
- Empower teams with the analytical capabilities to transform raw time-to-event data into actionable intelligence, fostering a data-driven culture.
- Leverage advanced analytical techniques to gain a competitive edge by anticipating future trends and optimizing operational efficiencies.
- Prevent costly failures, reduce waste, and improve efficiency by predicting and preparing for events before they occur.

Target Audience

1. Data Scientists & Analysts
2. Statisticians & Researchers.
3. Biostatisticians & Clinical Researchers
4. Actuaries & Risk Managers.
5. Marketing & Customer Analytics Specialists
6. Engineers & Reliability Professionals.
7. Economists & Social Scientists.
8. Healthcare Data Professionals

Course Outline

Module 1: Introduction to Survival Analysis

- Definition and Importance of Survival Analysis in various domains.
- Understanding Time-to-Event Data and its unique characteristics.
- Concept of **Censoring** (Right, Left, Interval) and its implications.
- Introduction to Survival Function and Hazard Function.
- **Case Study:** Analyzing patient survival times in a clinical trial with censored data.

Module 2: Descriptive Survival Analysis - Kaplan-Meier Estimator

- Non-parametric estimation of the survival function.
- Constructing and interpreting **Kaplan-Meier survival curves**.
- Median survival time and its interpretation.
- Comparing survival curves using the **Log-Rank Test**.
- **Case Study:** Comparing product reliability for two different manufacturing processes using Kaplan-Meier curves and Log-Rank tests.

Module 3: Introduction to Regression in Survival Analysis

- Limitations of traditional regression for time-to-event data.
- Introduction to the concept of proportional hazards.
- Overview of semi-parametric and parametric models.
- Introduction to covariates and their role in survival models.
- **Case Study:** Identifying baseline factors influencing loan default rates.

Module 4: The Cox Proportional Hazards Model

- Detailed derivation and assumptions of the **Cox PH Model**.
- Interpreting **Hazard Ratios** and their significance.
- Fitting Cox models in R/Python.
- Handling categorical and continuous covariates.

- **Case Study:** Assessing the impact of demographic factors and treatment on disease recurrence.

Module 5: Assumptions of the Cox Model & Diagnostics

- Checking the **Proportional Hazards Assumption** (graphical and statistical tests).
- Strategies for addressing violations of the PH assumption (stratification, time-varying covariates).
- Goodness-of-fit assessment for Cox models.
- Residual analysis in survival models.
- **Case Study:** Diagnosing PH assumption validity in a customer churn prediction model and applying appropriate adjustments.

Module 6: Time-Varying Covariates

- Understanding and incorporating **time-dependent covariates**.
- Modeling changes in risk factors over the observation period.
- Different approaches to handling time-varying effects.
- Practical implementation in statistical software.
- **Case Study:** Analyzing the effect of changes in marketing spend on customer subscription cancellation over time.

Module 7: Parametric Survival Models

- Introduction to various **parametric distributions** (Exponential, Weibull, Log-Normal, Gamma).
- Advantages and disadvantages of parametric models.
- Model selection criteria (AIC, BIC).
- Predicting survival times using parametric models.
- **Case Study:** Predicting equipment lifespan using a Weibull distribution for reliability analysis.

Module 8: Accelerated Failure Time (AFT) Models

- Introduction to AFT models as an alternative to PH models.
- Interpretation of AFT model coefficients.
- When to use AFT models versus Cox PH models.
- Fitting and interpreting AFT models in R/Python.
- **Case Study:** Modeling the time to recovery from an illness, focusing on accelerating or decelerating effects of different treatments.

Module 9: Competing Risks Analysis

- Understanding **Competing Risks** scenarios.
- Cumulative Incidence Function (CIF) and its interpretation.
- Cause-specific hazard models.
- Practical approaches to modeling competing risks.
- **Case Study:** Analyzing patient mortality due to different causes (e.g., disease progression vs. adverse events) in a clinical trial.

Module 10: Advanced Topics in Survival Analysis

- Frailty models for handling unobserved heterogeneity.
- Recurrent event analysis.

- Joint models for longitudinal and survival data.
- Non-parametric regression techniques for survival data.
- **Case Study:** Modeling hospital readmission rates, accounting for multiple readmission events for the same patient.

Module 11: Event Prediction and Forecasting

- Translating survival models into actionable predictions.
- Forecasting future events for individuals and cohorts.
- Probabilistic predictions and confidence intervals.
- Applications in business forecasting and operational planning.
- **Case Study:** Forecasting the number of product warranty claims over the next quarter based on historical failure data.

Module 12: Machine Learning for Time-to-Event Data

- Overview of machine learning algorithms applicable to survival data.
- Survival trees and random forests.
- Gradient boosting machines for survival outcomes.
- Deep learning approaches for event prediction.
- **Case Study:** Developing a machine learning model to predict customer churn risk with higher accuracy than traditional statistical models.

Module 13: Model Evaluation and Validation

- Metrics for assessing predictive performance (**C-index**, ROC curves for time-to-event).
- Cross-validation strategies for survival models.
- Calibration plots and internal/external validation.
- Techniques for comparing different survival models.
- **Case Study:** Validating a credit default prediction model using C-index and calibration plots on an independent dataset.

Module 14: Practical Implementation in R/Python

- Hands-on exercises with survival and survminer packages in R.
- Using the lifelines and scikit-survival libraries in Python.
- Data preparation and feature engineering for survival models.
- Automating survival analysis workflows.
- **Case Study:** Building an end-to-end survival analysis pipeline in R/Python for a real-world dataset.

Module 15: Interpreting Results & Ethical Considerations

- Communicating complex survival analysis findings to non-technical stakeholders.
- Developing compelling visualizations for survival data.
- Ethical considerations in predictive modeling (bias, fairness, privacy).
- Best practices for deploying survival models in real-world applications.
- **Case Study:** Presenting the findings of a patient survival study to a medical review board, focusing on actionable clinical implications.

Training Methodology

This course employs a highly interactive and practical training methodology, combining:

- **Instructor-Led Sessions:** Engaging lectures covering theoretical concepts and model intuition.
- **Hands-on Labs:** Extensive practical exercises using real-world datasets with R and Python.
- **Live Coding Demonstrations:** Step-by-step guidance on implementing models and interpreting outputs.
- **Case Study Discussions:** In-depth analysis of diverse industry applications to solidify understanding.
- **Group Activities & Problem Solving:** Collaborative learning to tackle complex challenges.
- **Q&A Sessions:** Dedicated time for addressing participant queries and fostering deeper understanding.
- **Reference Materials:** Comprehensive course notes, code samples, and recommended readings.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.com 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.

Trending Meta

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
07 Sep 2026	18 Sep 2026	Physical	$3,000
14 Sep 2026	25 Sep 2026	Physical	$3,000
21 Sep 2026	02 Oct 2026	Physical	$3,000
28 Sep 2026	09 Oct 2026	Physical	$3,000
05 Oct 2026	16 Oct 2026	Physical	$3,000
12 Oct 2026	23 Oct 2026	Physical	$3,000
19 Oct 2026	30 Oct 2026	Physical	$3,000
26 Oct 2026	06 Nov 2026	Physical	$3,000

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