



Departamento de
Estadística e
Investigación Operativa

CICLO DE CONFERENCIAS ESTADÍSTICA Y CIENCIA DE DATOS PATRICIA ROMÁN

15/10/2025

**Conferencia: 12 horas día 16 de octubre de
2025**

Título: Random Survival Forest for Censored
Functional Data

Conferenciante: Giuseppe Loffredo. Department
of Mathematics and Physics, University of
Campania "Luigi Vanvitelli"



Abstract:

This paper proposes an improved way to handle survival learning for time-to-event data by combining Functional Data Analysis (FDA) [1] with Random Survival Forests (RSF) [2]. Traditional survival models often have trouble dealing with complex, irregular, and censored functional data. To fix this, we introduce Censored Functional Data (CFD) [3], which captures each subject's data only up to the earliest of the event or censoring time, avoiding excessive interpolation and better representing the real data.

Using Functional Principal Component Analysis (FPCA) [4] and optimizing how time is discretized, our Functional Random Survival Forest (FRSF) framework efficiently models survival data that's irregularly observed. We tested it through simulations with different baseline hazard functions and found that the CFD-based FRSF outperforms traditional survival models, delivering better prediction accuracy measured by Continuous Ranked Probability Score (CRPS) and Requested Performance Error (RPE). Also, variable importance analysis shows that the CFD

model uses a wider range of principal components, which boosts interpretability and robustness. Overall, our method offers a flexible, nonparametric approach for survival analysis with complex functional predictors, improving both predictive performance and understanding of time-to-event data.

References

- [1] James O. Ramsay and Bernard W. Silverman, editors. *Applied Functional Data Analysis: Methods and Case Studies*. Springer New York, 2002.
- [2] Hemant Ishwaran, Udaya B. Kogalur, Eugene H. Blackstone, and Michael S. Lauer. Random survival forests. *The Annals of Applied Statistics*, 2:841–860, 2008.
- [3] G. Loffredo, E. Romano, and F. Maturo. Random survival forest for censored functional data. *Statistics in Medicine*, 44(5):e10344, Feb 2025.
- [4] Fang Yao, Hans-Georg Müller, and Jane-Ling Wang. Functional linear regression analysis for longitudinal data. *The Annals of Statistics*, 33(6):2873–2903, 2005.