Simona Fioretto

Process Mining Techniques for Operational Improvement in Public Administration

Tutor: Elio Masciari

Cycle: XXXVIII Year: II

Candidate's information

- MSc degree in Management Engineering @DII – Federico II
- DIETI Research group/laboratory:
  - PICUS Lab
- PhD start date – end date:
  - 01/11/2023 – 31/10/2025
- Scholarship type:
  - PNRR - DM 351 Mis.: I.4.1 Dottorati Pubblica Amministrazione
- Periods abroad:
  - 03/06/2024 – 02/12/2024
- Abroad research institution:
  - Centre de coopération internationale en recherche agronomique pour le développement (CIRAD)

Summary of study activities

	Description
Course	Strategic Orientation for STEM Research & Writing
Course	Machine Learning for Science and Engineering Research
Conference	27° International Symposium on Methodologies for Intelligent Systems
Research (I)	Systematic Literature Review on Predictive Process Monitoring
Research (II)	Application of Process Mining in Agriculture

Research field of interest

Operational Improvement in Public Administration with Process Mining

- Public Administration services lack of efficiency and effectiveness;
- Process Mining and Machine Learning can help in the identification and prevention of inefficiencies;

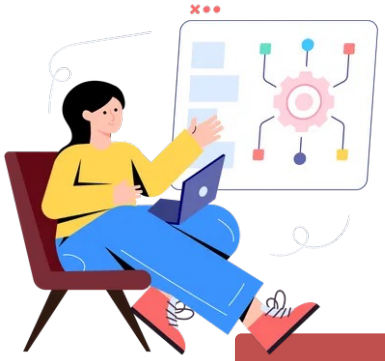
Research area

Problems

Business Processes in Public Administrations[1]..

- are unstructured processes;
- present data quality issues;
- exhibit high variability: activities and pathways vary significantly across cases;
- present important infrequent behaviors: rare events can impact analysis and predictions;
- have many related attributes and information;

Abroad Activities



Dataset Manipulation

Process Mining

Process Complexity Reduction

Outcome-based Prediction

[1] Munoz-Gama, Jorge, et al. "Process mining for healthcare: Characteristics and challenges." *Journal of Biomedical Informatics* 127 (2022): 103994.

Research Area: Results (I)

Methodology: Dataset Exploration

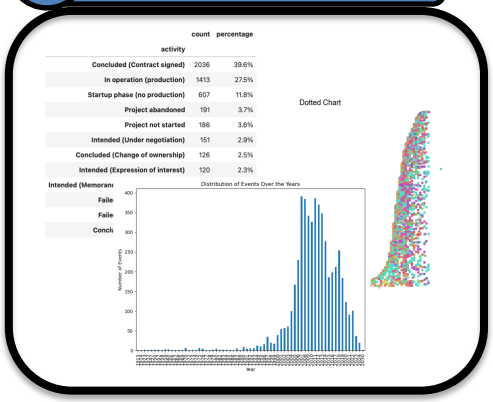
1 Dataset

Deal ID	Deal size	Target count	Current negotiation status	Current implementation status	Negotiation status	Implementation status
8	0.00	Cambodia	Intended (Under negotiation)	Project not started	2010#current#Intended (Under negotiation)	2011#current#Project not started
11	9380.00	Cambodia	Concluded (Contract signed)	None	2005#current#Concluded (Contract signed)	
13	7000.00	Cambodia	Failed (Contract cancelled)	Startup phase (no production)	2009##Concluded (Contract signed) | 2009#c	2008#current#Startup phase (no produc
15	25000.00	Cambodia	Intended (Under negotiation)	Project not started	2010#current#Intended (Under negotiation)	2010#current#Project not started

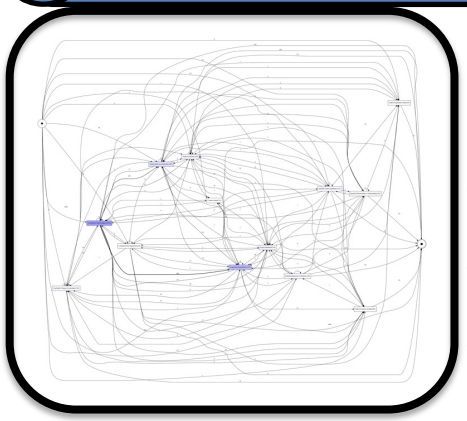
2 Event Log

Deal ID		activity	timestamp
1421		Failed (Negotiations failed)	2012-01-01 00:00:00+00:00
1423		Failed (Negotiations failed)	2010-01-01 00:00:00+00:00
1441		Failed (Negotiations failed)	2012-01-01 00:00:00+00:00

3 Process Mining



4 Directly Follow Graph

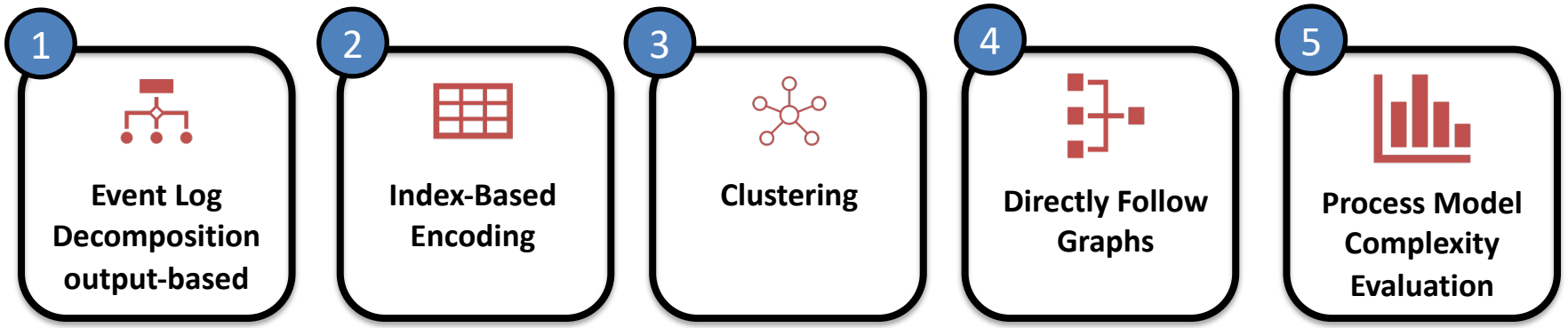


Spaghetti Chart Complexity Problem

- processes not well structured
- lot of diverse behavior (variants)
- difficult to understand

itee PhD information technology electrical engineering

Research Area: Results (II)
Methodology: Complexity Reduction



- failed deals
- in production
- work in progress

- control-flow perspective

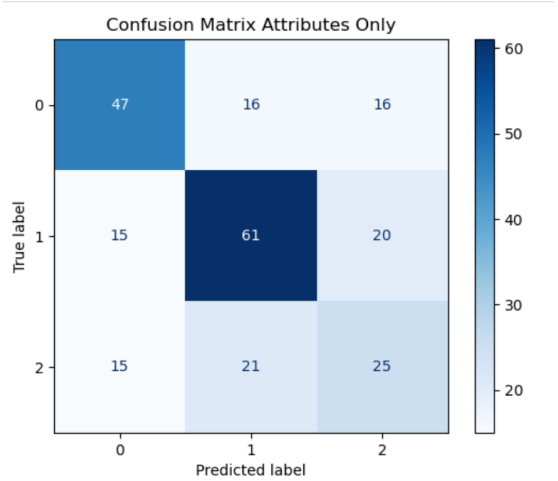
- AHC
- K-Means

- #Traces
- #Variants
- #Variants/Traces
- #Events
- Min. & Max. Trace Lenght
- #Vertices
- #Edges
- |E|/|V|

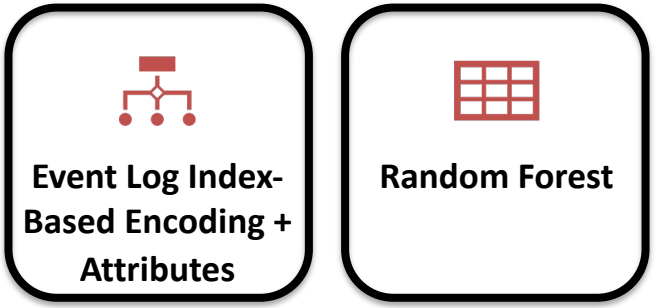
It is possible to reduce the complexity of a process based on control-flow information without the loss of any pertinent data.

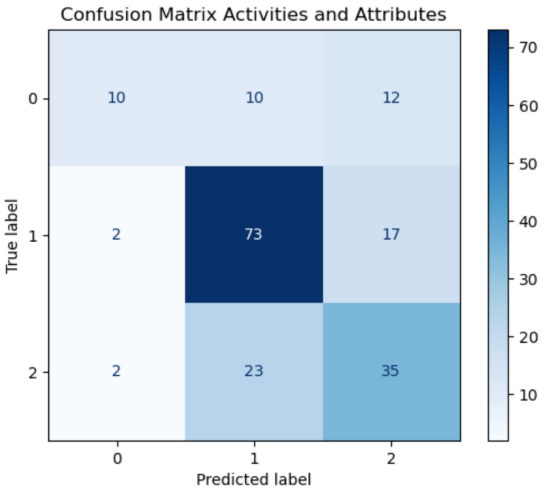
Research Area: Results (III)
Methodology: Classification

- Attributes only



- Event Log + Attributes





Research products

[P1]	S. Fioretto, D. Ienco, R. Interdonato, E. Masciari *Integrating Predictive Process Monitoring Techniques in Smart Agriculture,* **27° International Symposium on Methodologies for Intelligent Systems,** Scopus Indexed
[P2]	S. Fioretto, E. Masciari *A Conceptual Framework for Predictive Process Monitoring in Public Administration ,* **18-thInternationalConferenceonComplex,Intelligent,andSoftware Intensive Systems ,** Scopus Indexed
[P3]	S. Fioretto, E. Masciari, E.V. Napolitano, *Machine Learning for KPI Development in Public Administration,* **13° International Conference on Data Science, Technology and Application ,** Scopus Indexed
[P4]	S. Fioretto, E. Masciari, *Comprehensive Survey on Predictive Process Monitoring ,* **Knowledge and Information Systems Journal,** Under Review


THANK YOU