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Title : Counterfactual Explanations for Predictive Business Process Monitoring

KEY WORDS : LORE; LORELEY; CROSSOVER AND MUTATION; GENETIC ALGORITHMS

THE PAPER INTRODUCES LORELEY, A TECHNIQUE FOR GENERATING COUNTERFACTUAL EXPLANATIONS FOR PREDICTIVE BUSINESS PROCESS MONITORING. THE SOLUTION IS TO EXPLAIN WHY CERTAIN PREDICTIONS WERE MADE BY ADDRESSING THE CHALLENGE OF INTERPRETING BLACK-BOX PREDICTION MODELS USED IN PREDICTIVE PROCESS MONITORING. THE LORE TECHNIQUE IS IMPROVED BY LORELEY'S INCORPORATION OF GENETIC ALGORITHMS, WHICH GENERATE EXPLANATIONS BASED ON SYNTHETIC DATA INSTANCES. THE OBJECTIVE IS TO IMPROVE THE UNDERSTANDABILITY OF PREDICTION MODELS, PARTICULARLY WHEN ACCURATE PREDICTIONS ARE ESSENTIAL BUT THE LACK OF INTERPRETABILITY IS A RISK.

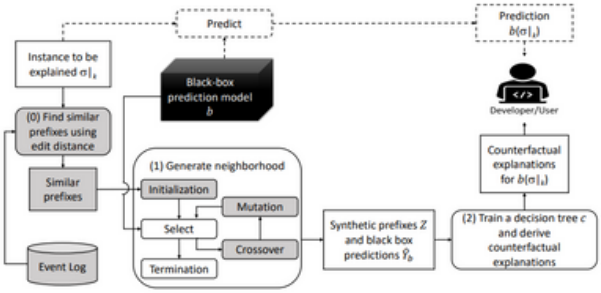

Fig. 1: Overview of LORELEY (extensions from LORE highlighted in grey)

THREE MAIN STAGES ARE INVOLVED IN THE APPROACH, INCLUDING INITIALIZING WITH SIMILAR PREFIXES, CONSIDERING CONTROL FLOW CONSTRAINTS DURING CROSSOVER AND MUTATION, AND EXPLAINING MULTI-CLASS PREDICTIONS. GENETIC ALGORITHMS ARE EMPLOYED BY LORELEY TO PRODUCE SYNTHETIC DATA INSTANCES THAT ARE IN COMPLIANCE WITH PROCESS CONSTRAINTS AND REPRESENT REALISTIC REPRESENTATIONS OF POSSIBLE SCENARIOS. USERS ARE ABLE TO UNDERSTAND THE REASONS FOR SPECIFIC PREDICTIONS THROUGH THE GENERATED EXPLANATIONS, WHICH ENABLES THEM TO MAKE BETTER DECISIONS AND HAVE MORE TRUST IN PREDICTIVE MODELS.

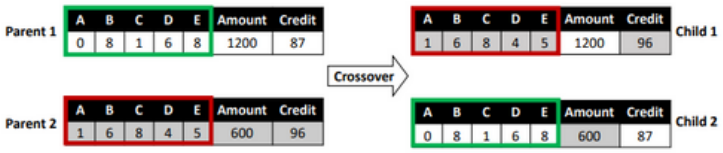

Fig. 2: Example for control-flow-aware crossover in LORELEY

LORELEY HAS BEEN SHOWN TO EXHIBIT HIGH FIDELITY IN APPROXIMATING THE LOCAL DECISION BOUNDARY OF BLACK-BOX PREDICTION MODELS THROUGH EXPERIMENTAL FINDINGS, WITH AVERAGE FIDELITY REACHING 97.69% FOR VARIOUS PREFIX LENGTHS. THE EXPLANATIONS GENERATED BY LORELEY ARE CONSISTENT WITH DOMAIN KNOWLEDGE, WHICH INDICATES THE EFFECTIVENESS OF THE TECHNIQUE IN PROVIDING VALUABLE INSIGHTS INTO PREDICTIVE PROCESS MONITORING. THE PAPER ACKNOWLEDGES THAT THERE ARE LIMITATIONS, INCLUDING THE DEPENDENCE OF THE SIMILARITY THRESHOLD ON PREFIX ENCODING AND THE DIFFICULTY OF IDENTIFYING INFLUENTIAL PREDICTORS USING CONTROL FLOW.

TO SUM UP, LORELEY PRESENTS A PROMISING METHOD TO ENHANCE THE INTERPRETABILITY OF PREDICTIVE PROCESS MONITORING MODELS BY PROVIDING COUNTERFACTUAL EXPLANATIONS. THE FUTURE TASK IS TO ADDRESS THE CURRENT LIMITATIONS AND FURTHER EVALUATE THE TECHNIQUE WITH BENCHMARK DATASETS AND DIFFERENT PREDICTION MODELS TO ENHANCE ITS APPLICABILITY AND ROBUSTNESS.