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#### Stochastic Process Mining By Weight Estimation Adam Burke, Sander Leemans and Moe Thandar Wynn



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# What process do commuters follow each morning?



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#### **Stochastic Process Discovery**





# Example Estimator (Inputs)

Log: [<a,b,c,d><sup>5</sup>, <a,c,b,d><sup>4</sup>, <a,b,b,d><sup>2</sup>, <a,b,c,b,d>]



#### Estimator Calculation - w\_freq

Log:  $[<a,b,c,d>^5,$   $<a,c,b,d>^4,$   $<a,b,b,d>^2,$ <a,b,c,b,d>]



# Estimator Calculation - w\_fork (Step 1)

Log:

[<a,b,c,d><sup>5</sup>,

<a,c,b,d><sup>4</sup>,

<a,b,b,d>²,

<a,b,c,b,d>]



# Estimator Calculation - w\_fork (Step 2)

Log: [<a,b,c,d><sup>5</sup>, <a,c,b,d><sup>4</sup>, <a,b,b,d><sup>2</sup>, <a,b,c,b,d>]



#### **Estimators**

w_freq	Lifts activity frequencies to transition weights
w_lhpair	Weights by predecessor activity-pairs
w_rhpair	Weights by successor activity-pairs
w_pairscale	Scaled w_rhpair for better human comparison
w_fork	Assigns activity-pair frequencies to places, then distributes to transitions
w_align	Alignments



# **Experiment Design**



# **Evaluation Questions**

- Any difference between estimators?
- Any difference between estimators and existing techniques?
- Run-time?
- How broadly applicable?



# Difference between Estimators (and RSD)

BPIC 2018 Control Log







BPIC 2013 Open Log







# Applicability - Sepsis example



# Summary

- Make discovering stochastic process models cheaper
- Build on existing discovery techniques
- Provide alternative discovery tools
- Shorter run times, better tolerance of event log variation
- ... But trade-off against quality
  - Still comparable quality

• Large problem space



# **Future Work**

- Improved estimators
- "Direct" stochastic discovery algorithms
- Stochastic process simplicity conformance measures
  - Structural
  - Behavioural





- Publicly available implementation
  - o https://github.com/adamburkegh/spd\_we

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Thank you for your time.

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