A PREDICTIVE PROCESS APPROACH TO RECOMMEND EMAIL RESPONSE

AUTHOR

Ralph BOU NADER
Marwa ELLEUCH
Meriana KOBEISSI
Walid GAALOUL
Boualem BENATALLAH
Nour ASSY

CONTEXT & PROBLEMS

- Process mining involves analyzing business process traces to identify inefficiencies and optimize their steps.
- Traces can be found in logs of information systems, including email systems.
- Process prediction uses data mining and machine learning to identify future activities in a process.
- Email traces can be used for process prediction, but their non-structured nature poses challenges.
- Existing works on email prediction mostly focus on enhancing email management, with limited consideration for the context of business processes.
- Some works combine email management with business process discovery or classifying incoming emails into BP activities.
- Making predictions in the context of process-oriented emails is not limited to identify future BP activities to be performed through emails. **It requires recommending the emails enabling BP actors performing these activities**.

PROPOSED APPROACH
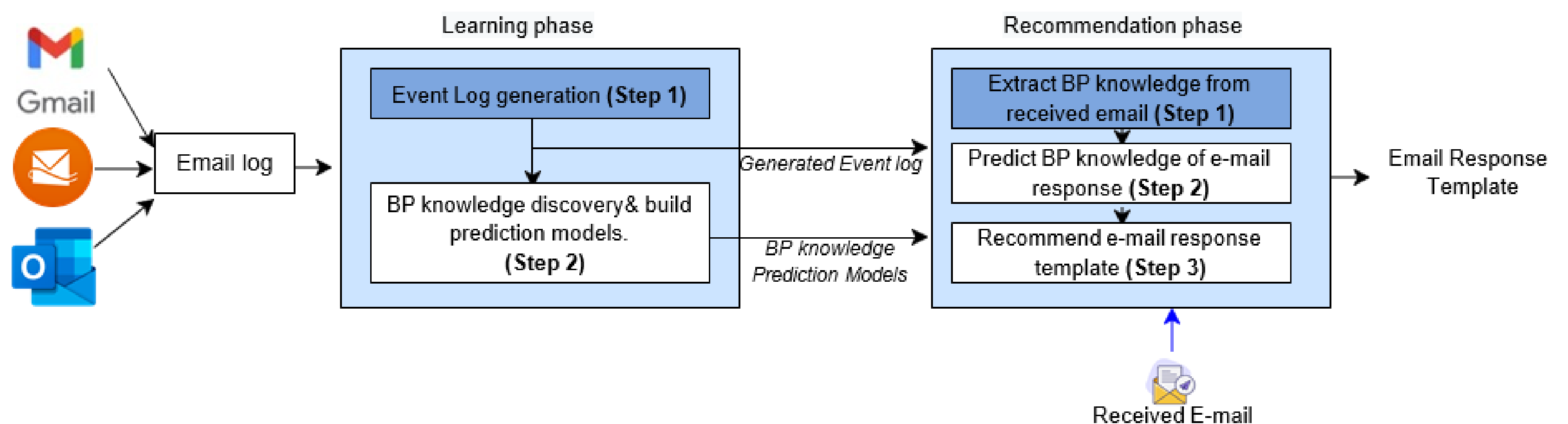
The above figure shows an overview of our proposed approach. The approach is divided into two phases:

THE LEARNING PHASE

- Goal is to learn BP knowledge for email responses from previously exchanged emails.
- Create structured event log from email log using non-supervised approach based on pattern discovery.
- Associate each event with activity occurrence, speech act, email-related attributes, and thread ID.
- Thread ID represents sequence of related activities and emails linked by response or forward relationship.
- Generated event log used to train and build prediction models for BP knowledge email response.
- Learn sequential relation between events in generated event log.
- Event log reduced into training dataset of event sequences to predict ordered events following one in relation to incoming email, considering antecedents in same email thread. Each thread in event log converted into sequence of events for this purpose.

THE RECOMMENDATION PHASE

- Discover sub-sequence of events in received email.
- Use prediction models to predict BP knowledge to include in email response.
- Feed sub-sequence of events into next-events prediction model to get combinations of events.
- Assign confidence value to each event combination based on intersection with previous emails.
- Retain event combination with highest confidence value.
- Feed each event in retained combination into sub-sequence prediction model to predict ordered events following it in received email.
- Assign confidence value to each predicted combination of ordered events.
- Choose predicted event sub-sequence with highest confidence value for email response.
- Generate email response template by discovering textual content related to BP knowledge.

Definition 1. Sequence of events A sequence of email events is defined as $S = s_1 \to s_2 \to ... \to s_n$ where:
(1) s_i is sub-sequence of events such that $s_i = e_{11} \mapsto e_{12} \mapsto ... \mapsto e_{ij}$. It refers to an ordered list of events belonging to the same email i. Each event is denoted by a single variable, say e_{ij}, where the index i refers to the email index in which the event belongs and j indicates the jth event of the sequence. Also, $e_{ij} \mapsto e_{i,j+1}$ means that in an email e_i, the event $e_{i,j}$ appears before $e_{i,j+1}$;
(2) $s_i \to s_{i+1}$ means that the sub-sequence s_i (appearing in the email i) proceeds the sub-sequence s_{i+1} (appearing in the email $i+1$) in terms of sending time;
(3) The index n (such that $n \geq 1$) refers to the number of sequential sent emails within a part of an email thread.

Dear {name},

This letter is to inform you that we received your application for {job_title}, in our research group {organization}. We are currently in the process of taking applications, if you are selected for an interview, our human resources department will be in contact with you by {datetime}. Thank you again for the time you invested in your application.

Kind regards,
{signature}

email confirmation Template

Journée des doctorants Samovar

Mars 2023