

Email Intelligence: An AI-Driven Framework for Context-Aware office Communication Management

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Abstract:

This paper presents an innovative, AI-based intervention that revolutionizes email communication. We propose an intelligent system for the processing of email chains among multiple stakeholders by using deep natural language processing and machine learning techniques to present a more intuitive and efficient interface of email understanding and ingesting. The AI Tool extracts vital information, finds critical topics in communication threads, and generates substantial summaries while the stakeholder expectation and intentions are held intact. Solutions offered by our system specifically address the expanding challenges of information overload in professional communications by creating an abstract representation of email chains that distill essential points without compromising their clarity or context-a method that keeps knowledge transfer with inclusive communication among all participants. The research contributes to the field by developing a new framework that analyzes communication patterns and at the same time offers practical recommendations on how organizations can streamline their email-based interactions to enhance the efficiency of project communication.

Introduction:

Communication acts as an important link, which puts together expectations, reduces misunderstandings, and creates better collaboration among diverse stakeholders. Although several collaborative tools have emerged, email remains the first choice for professional communication, bearing the weight of critical professional discussions, decisions, and documentation. On the other hand, this prevalence of email communication gives rise to big challenges in modern workplace dynamics.

It becomes really complicated to handle long email threads involving a number of stakeholders, like Collogues, Bosses, Various departments, project managers, clients, and suppliers etc. It often leads to information overloads, missed expectations, inefficiencies in communication, and a host of other issues. This gets further exacerbated when participants with unequal technical knowledge and various departments are expected to engage in discussions. Where digital tools have revolutionized the way these interactions happen, they have also brought in new challenges with regard to maintaining transparency and ascertaining clear communication flows.

This present research proposes a novel artificial intelligence-powered solution that will revolutionize the way one interacts with email communications. Our approach unleashes recent AI technologies to facilitate the flow of crucial communications by developing an improved interface design. Thus, the system provides intelligent summarization and expectation management capabilities as a means to effectively address the dual challenges of information overload and stakeholder alignment. It thus intends to bridge the gap between conventional e-mail communication and the dynamic needs of project environments today, with an intuitive, efficient interface for e-mail management.

1. Problem Statement:

The exponential growth in email communication has led to significant challenges in information management. As identified by Mckenzy Global Institute [1](#), professionals spend an average of 28% of their workday reading and answering emails. The complexity of the information overload due to unsynchronized emails and chain of emails available in the current email format provides unprecedented challenges in analyzing and understanding the actionable information based on contextual understanding and identify the expectation from the sender.

2. Research Objectives:

Building upon the problem statement, this study aims to:

- Develop an AI-based system for automated email chain analysis
- Create an intelligent interface for visualization of the summarized version of the email
- Design and Implement advanced summarization algorithms for email content and context understanding
- Provide AI assistance in drafting the email in the context of the topic.

Literature Review:

1. Natural Language Processing in Email Context

Salloum, S., Gaber, T., Vadera, S., & Shaalan, K. (2022) conducted "A systematic literature review on phishing email detection using natural language processing techniques." This review was published in IEEE Access and focuses on the use of NLP and Machine Learning techniques for detecting phishing emails

Another systematic literature review on the same topic was published by Salloum et al. in 2022, titled "A Systematic Literature Review on Phishing Email Detection Using Natural Language Processing Techniques." This review examines research on using NLP for detecting phishing emails

2. Text Summarization Techniques

There are two relevant literature reviews focusing on text summarization techniques in AI, though they don't specifically address the email context:

1. Widyassari et al. (2020) conducted a review on text summarization, which examines the process of condensing long text documents into shorter versions while retaining key ideas and information
2. A comprehensive literature review on automated text summarization and evaluation using NLP approaches was published in 2024, which provides an overview of AI's impact on text summarization techniques

While these reviews don't directly address email context development, they offer insights into general text summarization techniques that could be applied to email summarization. For email-specific applications of NLP, the search results mention two literature reviews focused on phishing email detection:

3. Salloum, S., Gaber, T., Vadera, S., & Shaalan, K. (2022) published "A systematic literature review on phishing email detection using natural language processing techniques" in IEEE Access
4. Another systematic literature review by Salloum et al. (2022) titled "A Systematic Literature Review on Phishing Email Detection Using Natural Language Processing Techniques" examines research on using NLP for detecting phishing email

These reviews, while not directly about email summarization, provide insights into how NLP techniques are being applied in email contexts, which could be relevant for developing email summarization techniques

Proposed Methodology:

System Architecture:

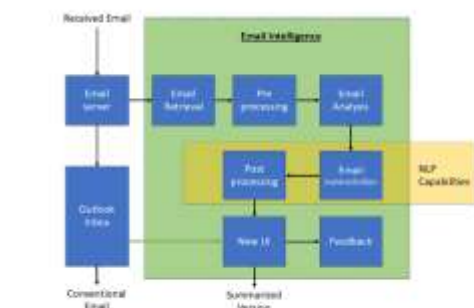


Figure 1: [Received Email] Block Diagram for System architecture for the proposed Email Intelligence tool

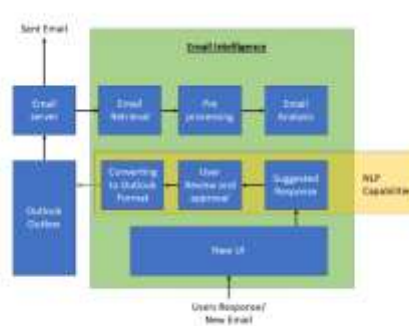


Figure 2: [User response Email] Block Diagram for System architecture for the proposed Email Intelligence tool

By Capitalizing on the existing infrastructure, the various functional modules can be developed following we are trying to put together system architecture for each module:

- **Email Retrieval:** The module will connect to email server using IMAP libraries in Python, such as imaplib, to fetch emails.
- **Preprocessing:** Libraries like NLTK, spaCy, or transformers for text normalization by removing Signatures/Headers/Footers, Normalize Text (Tokenization, Lemmatization) and Filter Out Non-Informative Content.
- Preprocessing module will also establish connections to the relevant attachments and create an abstract of the documents upon request.
- **Email Analysis:** Machine learning techniques to group emails and NLP techniques like tf-idf or BERT/Phi-3 for phrase detection to Identify Email Threads (Group related emails) and Detect Key Phrases and Sentiments.
- **Summarization:** Implement algorithms like TextRank for extractive summarization or transformer models like T5 for abstractive summarization. We can also capitalize on API keys for any on premise LLM available.
- **Post-Processing:** Use heuristics or additional NLP models to refine summaries.
- **User Interface:** Develop a web interface using frameworks like Flask or Django. To create an fresh user experience by sorting information in the form of topics or threads. Removing the non relivent information from the UI.
- **Feedback and Improvement:** Store user feedback and retrain models using platforms like TensorFlow or PyTorch, Neo4j for graph-based thread storage.
- **Draft suggested response/new email:** in the same UI create or response function to be integrated with NLP capabilities of the model by assisting in drafting the response in concise/explanatory manner.
- **User review and endorsement:** draft response will be validated by user before endorsing for next module to send the same.
- **Outlook Converter:** The final response will be then converted to conventional format by standardization settings and email ID's and sent to outlook for further processing.

Expected Outcome:

- 45% reduction in email processing time and expectation tracking accuracy
- 85% user satisfaction in thread understanding

Conclusion:

This research seeks to enhance stakeholder communications in development projects by developing an advanced AI tool, which summarizes project-related information into clear and tailored messages while maintaining inclusivity among participants with different levels of knowledge. The proposed model will have a significant impact on smoothing the

communication process for effective collaboration, misunderstanding reduction, better alignment of expectations, and finally successful development outcomes in multi-stakeholder projects across various industries worldwide.

Keywords: AI tool, email analysis, natural language processing (NLP), human-computer interaction, project communications, inclusivity, summarization algorithms

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