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USING LARGE LANGUAGE MODELS IN PROJECT MANAGEMENT

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Purpose: The purpose of this work is to present preliminary research results on the automatic detection of destructive emotions in project management using large-scale language models. The paper aims to present an architecture for identifying negative emotions in open-source projects.
Design/methodology/approach: This article focuses on identifying destructive emotions in text-based communication available in open-source projects through the use of Large Language Models (LLMs). Using available training data with labels describing emotions associated with text, the BERT model is instructed to identify basic emotions in text. The LLM model will be trained to identify instances where anger—an example of a destructive emotion—appears in email correspondence related to open-source projects. The trained model can then be used to identify emotions in further correspondence. This approach will be used to develop a system architecture that will enable automatic emotion identification.
Findings: The results of this study demonstrate that it is possible to configure Large Language Models (LLM) to identify emotions in project-related electronic communications. Detailed research is needed to confirm the effectiveness of this approach. However, such research requires significant computing power.
Research limitations/implications: The study concentrated on the potential of Large Language Models to automatically detect emotions in project management communication. Rather than achieving high-quality identification, the objective was to validate the concept of utilizing Large Language Models for this purpose. The sole instance of such a model utilized was BERT.
Originality/value: The novelty of this paper is the attempt to use Large Language Models to automatically detect emotions in project management. Previously, this type of analysis used dictionary-based methods for sentiment analysis. This paper continues the idea of identifying negative emotions.
Keywords: project management; emotion recognition; natural language processing, Large Language Models.
Category of the paper: Conceptual paper.

1. Introduction

Traditionally, project management focused solely on the three fundamental dimensions defined by the project management triangle: scope, time, and cost. As the perspective on project success shifted (Jugdev, Müller, 2005), with stakeholder relationships playing a significant role, the perception of emotions also changed. They ceased to be a distraction and became a crucial parameter to consider when managing projects.

In modern project management, the most important key parameter is stakeholder engagement. Engaging stakeholders, including customers, employees, investors, and regulators, is crucial for project success. Clear communication, managing expectations, and addressing stakeholder concerns are essential to maintain support and alignment throughout the project life cycle.

In contemporary projects, stakeholder relations rely on electronic communication tools. This creates ample opportunity to utilize advanced analysis based on Natural Language Processing (NLP). Many computer methods of natural language processing are currently being developed. They are methods of text and speech processing (speech recognition, word segmentation), morphological analysis (lemmatization, stemming), syntactic analysis (parsing), lexical semantics (sentiment analysis with emotion recognition, terminology extraction), and many others like automatic summarization and machine translation. Sentiment analysis seems to be a particularly useful tool for analyzing communication in a project. Another tool being developed in this area is emotion identification.

The latest tool developed in NLP, widely used in many areas of human activity, is Large Language Models (LLM). Large language models are neural networks and are classified as generative artificial intelligence. Examples of LLMs include the GPT series built by OpenAI, used in the ChatGPT, Google Gemini, Microsoft Copilot chatbots, and the Llama models built by Meta Platforms. There are also Chinese models like DeepSeek and Polish models like Bielik and PLLuM (Large language model, 2025).

Nagarajan (2024) presents possible areas of application of LLM Project Management:

- Decision Support: LLM acting as an assistant for project managers to brainstorm risks, identify potential stakeholders, or suggest mitigation strategies.
- Task Automation: LLM can help PM generate project artifacts, such as creating a project charter, creating a work breakdown structure (WBS), or writing status reports.
- Information Retrieval: Briefly summarizing and extracting key information from vast amounts of project documentation (e.g., contracts, past lessons learned, and technical specifications).
- Communication: LLM can assist in drafting clear and consistent communications for different stakeholders, including emails, presentations, and reports.

In this paper, we propose yet another application of AI in project management: analyzing emotions occurring in projects. Given its crucial importance in stakeholder management, this tool may have promising applications.

The aim of this paper is to present findings in automatic destructive emotion detection in project management with Large Language Models.

The paper is divided into the following parts. The first section presents a literature review of the topics of interest. The next section describes the data used and the research procedure employed. This section also presents the research question. The next section presents the obtained results. The next section presents a discussion of the obtained results. The whole paper ends with a summary.

2. Literature survey

2.1. Psychology in Project Management

Clarke (2010) was probably the first to notice that projects are emotional. However, despite previous work on the significance of conflict in projects (Chen, 2006) and recognizing that conflict is a source of strong emotions (Barki, Hartwick, 2004), the topic of recognizing emotions in the project has not been considered in the literature on the subject. In the mentioned paper, Clark (2010) analyzes how emotions affect project manager behaviors and decisions to better understand why projects go in very different directions from those expected within the predominant rationalist paradigm. He interviewed PMs who participated in emotional intelligence training, and they understood the importance of emotion in decision-making.

Today four key concepts emerge in the area of emotion analysis in the context of project management.

The first, pioneered by Goleman, is the analysis of emotional intelligence focused on the project manager. The research in this area applies Goleman's (1996) model of Emotional Intelligence (EQ) directly to the project manager's role. This model includes self-awareness of the PM, who recognizes his emotions and understands how they affect their team and decisions. The PM's self-regulation means the PM controls his impulses. Can the PM remain calm and professional during a crisis instead of panicking or blaming others? PM Empathy: Can he accurately read the emotional state of team members and stakeholders? PM Social Skills, if the PM can use their understanding of emotions to build rapport, influence stakeholders, communicate clearly, and resolve conflict (Rodrigues et al. 2024).

The second key concept is focused on the emotional dynamics of project teams. This body of research moves beyond just the project manager and looks at the project team as an “emotional system”. Mogård et al. (2022) discussed psychological safety. Team members

who feel psychologically safe are more likely to admit mistakes, ask questions, and propose innovative ideas, which is critical for solving complex project problems. Sigal et al. (2018) discussed emotional contagion. A single, highly negative team member can poison the group's morale, while an optimistic and resilient PM can create a positive climate. As projects are, by definition, temporary, high-pressure environments, much research is devoted to stress, burnout, and resilience (Mubarak et al., 2022).

The third key concept is devoted to emotion in project decision-making. This research applies behavioral economics to project environments (Manderscheid, Brynteson, 2015).

The fourth key concept is devoted to stakeholder emotional management. Projects fail more often due to stakeholder issues than technical ones. These papers focus on the PM's role in managing the emotions in projects. Managing Expectations, Emotional Labor, and Negotiation and Conflict are discussed in this area. Sentiment analysis is also used (Targiel, 2023) and emotion identification (Targiel, 2024).

2.2. Human emotions

Human emotions are a very complex phenomenon. For this reason, models of this phenomenon are considered in psychology. A fairly wide overview of the models can be found in (Nandwani, Verma, 2021). The most widely used are the Ekman model (Ekman, 1992) and Plutchik's Wheel of Emotions (Plutchik, 1980). The Ekman model is a categorical one, with six defined emotions: anger, disgust, fear, joy, sadness, and surprise. Plutchik considered two types of emotions. Basic ones, which include Ekman's six emotions supplemented by trust and anticipation, and mixed emotions, which are made from the combination of basic emotions. Plutchik represents his emotions on a colored wheel. The Plutchik model is also a categorical one. The opposite type of models are dimensional emotion models (Nandwani, Verma, 2021). They are based on three parameters: valence (positive, neutral, or negative), activation or arousal (excited, neutral, or calm), and dominance or power (weak, neutral, or strong).

In the context of project management, destructive emotions may be of particular importance. They can significantly impact team dynamics, decision-making, and consequently overall project success. A short catalog of such destructive emotions is presented below:

- **Anger:** Anger can arise from conflicts, unmet expectations, or stress. It can lead to hostility among team members, creating a toxic work environment and hindering collaboration. For these reasons, it is especially important to recognize these types of emotions (Hekkala, Stein, 2016; Wang et al., 2023).
- **Frustration:** Frustration often stems from obstacles or setbacks. It can result in decreased motivation and productivity, making it harder for teams to focus on goals. It is not that important, but it affects the productivity of individual team members (Hartman, Jugdev, 1998; Jugdev et al., 2000).

- **Fear:** Fear of failure, criticism, or the unknown can inhibit creativity and risk-taking. Team members might avoid voicing ideas or addressing issues, which can stifle innovation. Such emotions reduce the creativity of the design team (Hartman, Jugdev, 1998; Jugdev et al., 2000).
- **Jealousy:** Jealousy can occur when individuals feel threatened by colleagues' success. This can damage relationships and foster competition instead of collaboration (Andiappan, Dufour, 2020).
- **Anxiety:** Anxiety about deadlines, performance, or the project's future can lead to decreased focus and increased stress levels, causing team members to struggle to perform at their best (Wang et al., 2021).
- **Despair:** A sense of hopelessness about project outcomes can lead to disengagement and lack of effort from team members, jeopardizing project timelines and quality (Potosky, Azan, 2023).

Project managers can employ several strategies to mitigate the impact of these destructive emotions on project success. Some of them are fostering open communication, setting clear goals, promoting a positive culture, and encouraging reflection. In case of anger and frustration, they can provide conflict resolution resources. They can equip the team with tools and techniques to resolve conflicts constructively. However, such support is based on recognizing the emotions occurring. Hence the importance of methods for recognizing destructive emotions.

2.4. AI and Project Management

There has been a significant increase in the development of computer natural language processing methods in recent years. After the first periods of Symbolic NLP (1950s–early 1990s) and Statistical NLP (1990s–2010s), present NLP methods have gigantic potential for implementation. Dinov (2018) defines Natural Language Processing (NLP) as the automated execution of machine-driven algorithms to comprehend human language and extract information. Lexical semantics, relational semantics, syntactic analysis, morphological analysis, discourse, and text and speech processing are typical tasks for these approaches (Natural Language Processing, 2025). Natural language production, machine translation, and automatic summarization are a few of the new uses. Sentiment Analysis (SA) and Emotion Analysis (EA) are highly intriguing areas of NLP development in the context of project management, as they facilitate emotion recognition.

Müller et al. (2024) provide a comprehensive editorial that synthesizes the current state of AI in project management research. It demands more rigorous empirical research to verify the real-world effects of AI tools and establishes a research agenda for the future. The publication of Korczak et al. (2023) offers a more comprehensive examination of the application of generative AI in management. It underscores the potential of integrating LLMs with Business

Intelligence (BI) systems to enhance managerial decision-making and provide more sophisticated analytical insights for project control.

The application of Large Language Models to “knowledge work,” which is the foundation of project management, is covered in the Brachman et al. (2025) paper. It explores categories of use like creation, information retrieval, and automation, all of which are directly relevant to project management tasks.

Karnouskos's (2024) paper directly evaluates the capabilities of LLMs like ChatGPT by testing their performance on project management certification questions. The paper comes to the conclusion that LLMs and project managers should be seen as a "dynamic duo", with the LLMs adding to human skills rather than taking them away.

Chen's paper from 2024 talks about the problems developers face when they try to use LLMs to make apps, such as API errors, outputs that are hard to predict, and security issues. This challenge is directly applicable to any team that is attempting to develop custom PM tools using LLMs.

Some research investigates the use of LLM-powered agents within the Scaled Agile Framework (SAFe). It provides empirical results on how these agents can perform roles and improve project metrics in a simulated environment (Cinkusz et al., 2024).

The systematic review, which is available in (Bento et al., 2022), provides a comprehensive overview of the landscape of AI applications in project management, including decision support, risk management, and automation. It provides an excellent pre-LLM baseline for understanding the evolution of AI in the field.

3. Methods

3.1. Data on communications

Typically, communication within a project takes place through designated channels and is confidential. Fortunately, communication in open-source software projects relies on mailing lists, which are, by definition, publicly available. An example of such a project is the Apache Foundation's OpenOffice project.

The mailing list of the Apache OpenOffice project, implemented in the open-source formula, was selected in this work. Project communication is publicly available at "https://openoffice.apache.org/mailing-lists.html". The mailing list has been in operation since 2011. Several hundred messages show up on all sublists combined each month.

The eighteen channels of communication for the project are shown as mailing lists with themes. These mailing lists fall into two categories: English Language Mailing Lists and Native Language (non-English) Mailing Lists. There are German, Japanese, Italian, and French lists

among the second ones. Our attention will be on lists in English. Specifically, the mailing lists for developers and users are very active. Several hundred emails appear on these lists every year. Native language lists aren't as active, receiving only a few dozen emails per year. Against this background, the German list is particularly active, receiving up to three hundred emails per year.

3.2. Data on emotion patterns

In the 1990s, a group of psychologists all over the world collected data in the ISEAR project, directed by Klaus R. Scherer and Harald Wallbott (1994). Students were asked to describe instances in which they had felt each of the seven main emotions. In each case, the questions covered the way they had appraised the situation and how they reacted. The final data set thus contained reports on seven emotions, each by close to 3000 respondents in 37 countries on all 5 continents.

Table 1.
Structure of the ISEAR dataset

Emotion	Text
joy	"On days when I feel close to my partner and other friends. When I feel at peace with myself and also experience a close contact with people whom I regard greatly"
fear	“Every time I imagine that someone I love or I could contact a serious illness, even death"
anger	"When I had been obviously unjustly treated and had no possibility of elucidating this"

Source: own elaboration.

The ISEAR dataset is the outcome of this project, which comprises a collection of sentences that have been labeled. This is a collection of 7516 sentences labeled with 7 major emotions (joy, fear, anger, sadness, disgust, shame, and guilt). Using this set, a neural network was trained to identify the main emotions. The structure of the ISEAR dataset is shown in Table 1.

3.3. Large language models

A wide range of LLM models is currently available. Table 2 summarizes the available models. The rate of new model development is particularly interesting. In 2023, five new models were introduced and are being further developed into higher versions.

In this paper, the oldest BERT model was considered, as the best understood one. However, the existence of a wide range of other models offers the opportunity to improve the quality of the obtained identifications.

3.4. Research questions

Previous research on the analysis of sentiment in open-source projects (Targiel, 2022) and attempts to identify emotions in this communication using neural networks (Targiel, 2023) inspired the concept of utilizing Large Language Models for this purpose.

Table 2.
The most well-known models of large language

No	Name	Type	Size (No param.)	Developer	Introduced
1	BERT	transformer-based model	1.27B (BERT. xlarge)	Google	2018
2	Claude LLM	Closed-source	No official number	Anthropic	2023
3	Gemini	Closed-source	No official number	Google	2023
4	Gemma	open-source language models	27B (Gemma 3)	Google	2024
5	DeepSeek-LLM	open-source reasoning model	67B	DeepSeek	2023
6	GPT-3	Closed-source	175B (davinci)	OpenAI	2020
7	GPT-4	Closed-source	~1.8T	OpenAI	2023
8	LLaMA	transformer architecture	400B (Maverick)	Meta	2023

Source: own elaboration.

Large language models (LLM) are neural networks (NN) that are trained using self-supervised machine learning on a vast amount of text, such as Wikipedia articles and works of fiction. These networks learn the syntax, semantics, and ontologies present in human language corpora by utilizing vast amounts of data. It's possible to fine-tune LLMs to do certain jobs.

Thus, the following research question emerges:

RQ1: Using fine-tuned Large Language Models, is it possible to find negative emotions in project communication?

A positive answer to this question creates the possibility to quickly recognize negative emotions, especially destructive ones, which could help prevent potential conflicts in project teams and increase their effectiveness by reducing emotional contagion.

3.5. Research procedure

The research procedure involves analyzing available literature to then select appropriate components for the proposed system's architecture. This begins with selecting appropriate patterns for training neural networks, proceeding through selecting the neural network architecture implemented using the language model, and finally, finally, the method of utilizing the trained language model. Selecting appropriate metrics to evaluate the effectiveness of the proposed solution is also crucial.

4. Results

The main result of the research is a proposed architecture for emotion identification research in open-source projects. It is presented in Figure 1.

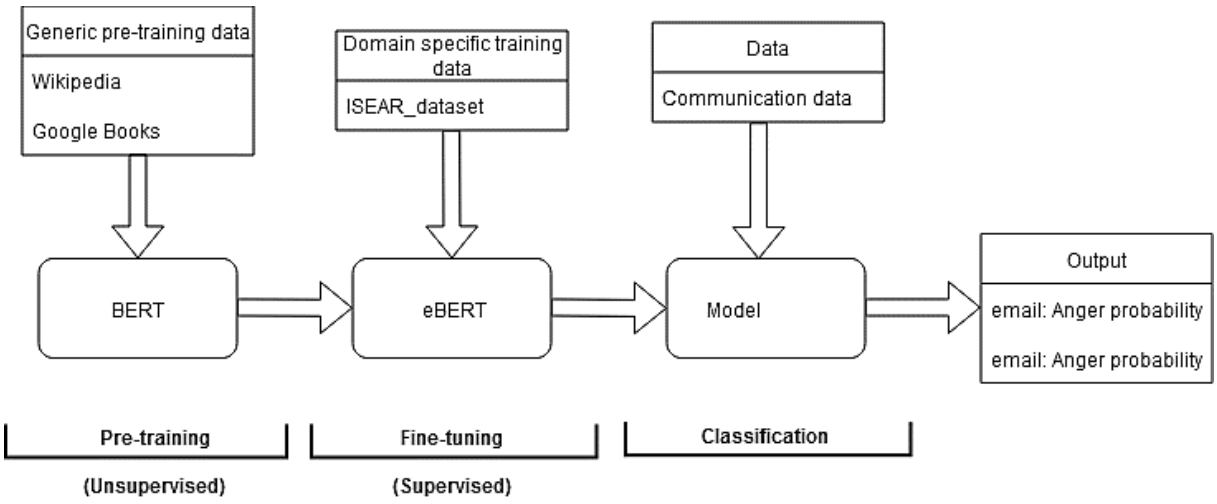

Figure 1. Architecture of the proposed system.

Source: own elaboration.

The ISEAR dataset is prepared for training by converting the emotions described in the dataset into numerical values in a manner that is appropriate. The ISEAR dataset has the structure shown in Table 2. A series of consecutive integers from 1 to 7 were used to encode the seven emotions that were present in this dataset.

Fine-tuning the BERT model entails instructing it to classify emotions that are present in the ISEAR dataset. The result is a neural network that can classify emotions based on text.

Then, the network trained in this way is used to find negative emotions (anger) in the communication set of the OpenOffice project.

The messages identified by the NN are then manually verified for the presence of negative emotions such as anger. The architecture of the proposed system can be seen in Figure 1.

The entire procedure can be written in the following steps:

1. The ISEAR dataset's preparation for training.
2. Fine-tuning the BERT model.
3. Using the trained BERT model to identify messages in the communication set.
4. Manual verification of identified messages.

The use of the above procedure will not only allow for the identification of negative emotions but also for the verification of the quality of the procedure.

5. Discussion

Our research identified the correct architecture for identifying emotions in mailing lists. This method has not been used in project management before, as far as we know. Nevertheless, many authors have demonstrated the significant importance of emotions in projects (Goleman, 1996; Sigal et al., 2018). However, they refrained from employing AI in their investigation. Our results indicate that it is feasible to implement artificial intelligence techniques for emotion identification. The effectiveness of this approach is unknown at this time.

Further research plans include implementing the proposed architecture. This will enable testing its effectiveness. However, this requires access to significant computing power. The research question can be satisfactorily addressed based on the results that have been obtained.

6. Summary

The cloud environment of Amazon Web Services was utilized to implement the system depicted in Figure 1. Adapted scripts described in (Fregly, Barth, 2021) were used. This demonstrated the ability to identify emotions in electronic communications generated in open-source projects. For this purpose, OpenOffice project data (OpenOffice, 2025) were used. Fine-tuning needed a lot of computer power. Therefore, the primary objective was to verify the hypothesis, rather than to achieve satisfactory outcomes.

The presented work is only a preliminary step in a broader effort to develop a system for automatic detection of negative emotions in IT projects. Its intended scope is limited to projects where communication is publicly available, such as open-source projects. Its new contribution is the specific architecture of the proposed solution. Positive results obtained from further research allow the proposed system to be used for more effective IT project management.

After access to high-performance computing power becomes available, future research will concentrate on obtaining precise, fine-tuned models. There is evidence that these models may have practical applications.

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