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Worker-robot collaboration in hospitality tasks: Revealing robotic integration opportunities through image analytics

Robin Simpson,[1] Dr. Pei Zhang[2] and Dr. Ningqiao Li[3]

[1]Student Researcher, California Polytechnic State University, College of Engineering, 1 Grand Ave, San Luis Obispo, 93401, CA, United States, [2]Experience Industry Management, California Polytechnic State University, College of Agriculture, Food and Environmental Sciences, 1 Grand Ave, San Luis Obispo, 93401, CA, United States and [3]Conrad N. Hilton College of Global Hospitality Leadership, University of Houston, 4450 University Dr, Houston, 77204, TX, United States

Abstract

This research project explores a critical question at the intersection of technology and service: How can collaborative robots be optimally integrated within the hospitality industry to bolster the synergy between human and robot workers? The focus is to pinpoint specific areas and tasks in hospitality settings where robot-human collaboration can effectively reduce the workload of human staff. The study stands out for its attention to the hospitality industry, a sector still experimenting and exploring the full benefits of robotic assistance, particularly in contrast to manufacturing. Notably, while Asia has seen widespread adoption of robotics in this domain, North American and European markets are just beginning to explore these possibilities. This project aims to identify where robots can meaningfully contribute to the daily operations of hotels, restaurants, and similar venues, thus enhancing overall efficiency and customer experience. Our methodology is rooted in a data-driven approach. We plan to compile an extensive dataset of images depicting robots in various hospitality environments. This dataset, sourced through targeted web scraping using specific keywords, will be systematically categorized into 'yes', 'no', and 'unsure' segments based on the relevance of robotic assistance in each image. Annotators then label these images to identify the specific roles. These labeled images assist in the development of a machine learning model that will provide deep insights into current trends and future potential for robotic deployment in hospitality. We aim to uncover patterns in robot utilization and effectiveness, offering strategic guidance for their integration. We anticipate that this study will yield significant insights into effective robotic integration in hospitality, paving the way for a more efficient and sustainable service industry. The findings will be crucial for industry professionals and policymakers, providing a roadmap for enhancing operational efficiency, worker well-being, and customer satisfaction through innovative human-robot collaboration.

Introduction

The hospitality industry, known for its emphasis on personal service and human interaction, is on the brink of a technological revolution with the introduction of collaborative robots. This research investigates how these robots can be integrated into hospitality settings to work alongside human staff, aiming to improve efficiency and enhance the customer experience. The study is particularly relevant as it explores an area that, unlike manufacturing where robots are commonplace, is still relatively new to the hospitality sector.

While some regions, like Asia, have already started to incorporate robotics extensively in hospitality, Western markets like North America and Europe are only beginning to explore these possibilities. This contrast presents an opportunity to study how cultural and operational differences influence the adoption and effectiveness of robotics in hospitality. The aim is to understand where robots can be most useful in supporting human staff in hotels, restaurants, and similar environments.

To achieve this, the study employs to research the relevance of robot-human interaction in hospitality by collecting a wide range of images that show robots in different hospitality settings. This collection will be done through targeted online searches using specific keywords. The images will be organized and analyzed to identify the roles where robots are already being used and where they have the potential to be useful. This visual analysis will help to pinpoint the specific tasks in hospitality where robot-human collaboration is most effective.

The underlying assumption of this research is that integrating robots into the hospitality industry can lead to better service and more efficient operations. However, this integration needs to be done thoughtfully, considering the industry's focus on personal interaction and customer service. The research aims to provide insights that will help industry professionals and policymakers make informed decisions about using robotics in hospitality.

Research Progress Report

Robin Simpson

Week 2: October 29, 2023 to November 5, 2023

1 Objective

Sort through a dataset of 10,755 (current) images into respective Yes/No/Unsure categories.

Sub-objectives

- Develop simple python sorter and analyze trends.

2 Activities

Dataset Preparation

- Created a script that allows me to load images based on folders and sort via [(Yes),] (No), — (Unsure).

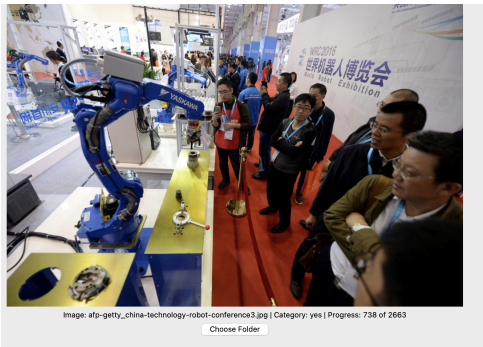

Figure 1: UI

- Stored results into a JSON kv pairing to ensure original dataset is unchanged.

Figure 2: Stored JSON

Analysis

- Created a script that allows me to load JSON Files and analyze the KV pairings.
- Utilized Pandas, Seaborn, Matplotlib, and Tkinter to analyze and visualize findings.

3 Results and Discussion

Initial Findings

- Presence of Duplicates
- Ambiguity (May result in False Positive/False Negative)

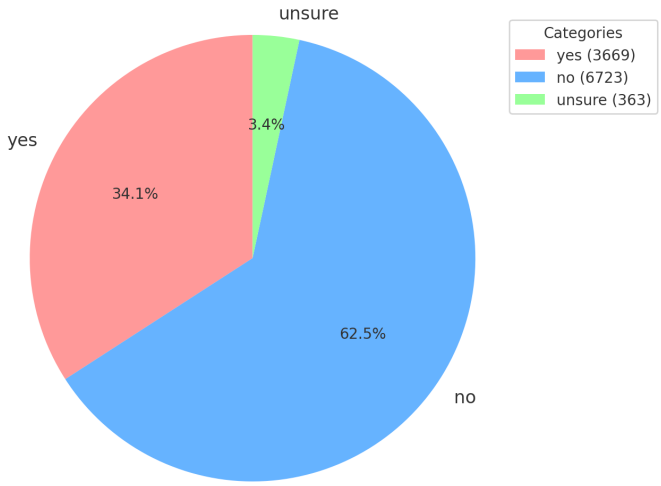

Figure 3: Overall distribution of category from the original dataset.

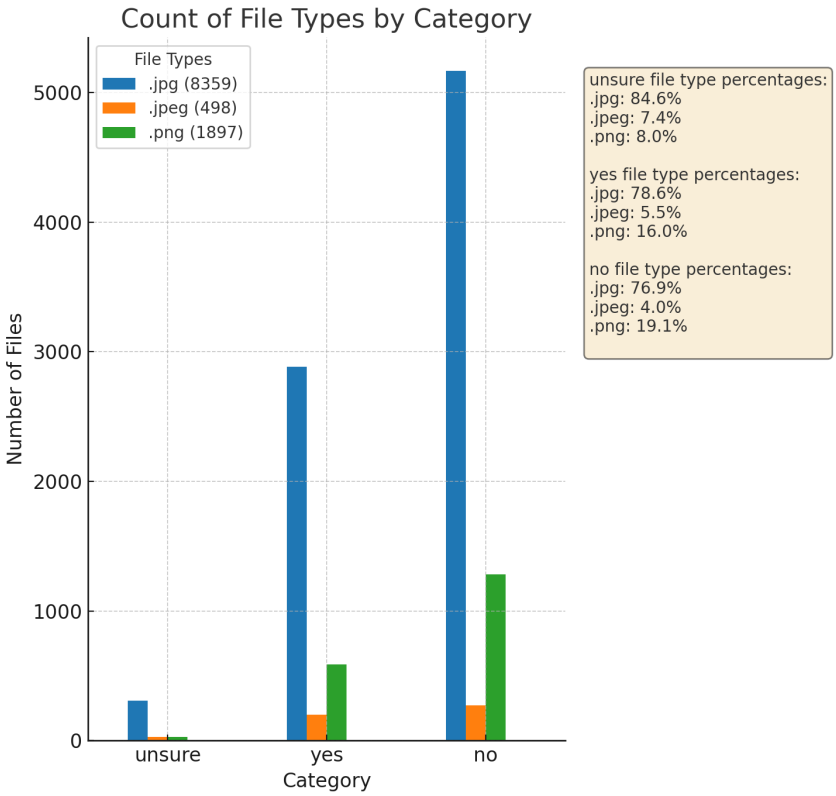

Figure 4: Overall distribution of image types from the original dataset.

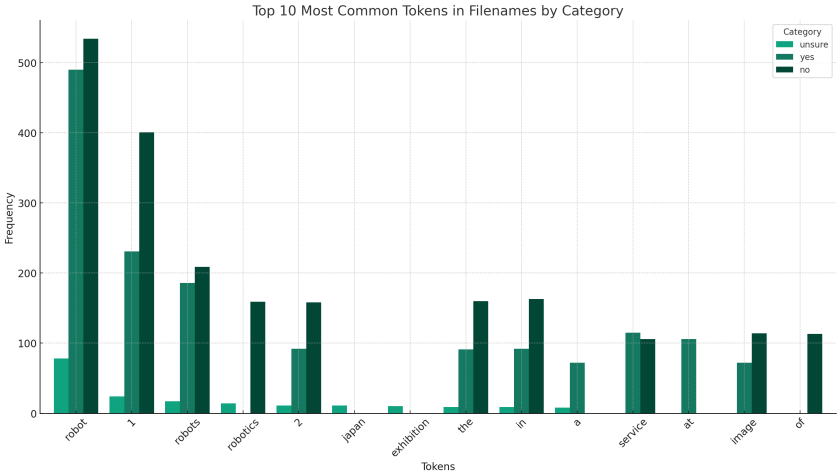

Figure 5: Most common words in filename vs category.

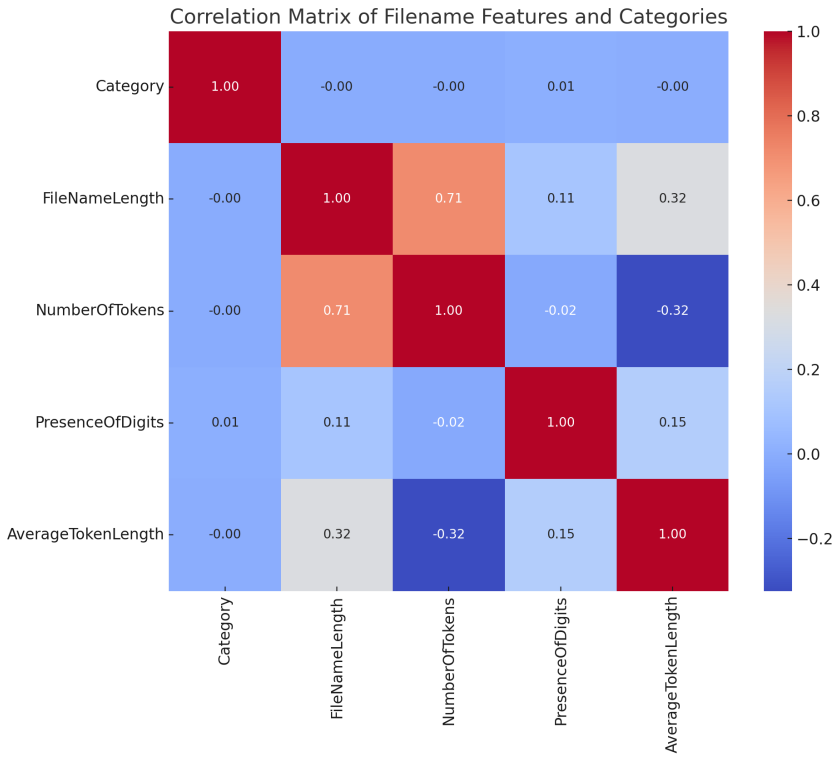

Figure 6: Correlation matrix of filename vs category.

4 Appendix

The Sorter Repo