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Learnings from a Pilot Hybrid Question Answering System: CQAS

Case Study based on a Singapore Government Agency's Customer Service Centre

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ABSTRACT

The Singapore Government first released their digital government blueprint in 2018 with the key message for all their agencies to be "digital to the core and served with heart". With this push, agencies are moving towards human-centric digital services, especially for individual citizens. During COVID-19, Singapore government agencies introduced many COVID-19 digital initiatives resulting in more incoming inquiries from citizens to respective agencies. This surge in inquiries created the challenge on the agencies' end to meet service level agreements. One widely adopted solution is the use of chatbot technology that directly interfaces with the customer. However, several organisations have faced backlash from the citizens or customers when such chatbots cannot answer or give inappropriate answers to the questions. Hence this research takes a different approach to address this challenge using a question answering (QA) system that supports the CSOs to help answer the citizen inquiries more efficiently.

This paper shares our learnings from implementing the pilot QA system; the Citizen Question Answering System (CQAS) was built using a hybrid QA approach that combines techniques from Natural Language Process QA, Knowledge-based QA and Information Retrieval QA. We also highlight the essential learnings in implementing QA systems within a government agency. The research will further share how these learnings could inform the adoption of QA systems in a government setting. The subsequent research following this paper will then focus on conducting a user study with the CSOs to validate further the benefits of this pilot QA system, which is not covered in this paper.

CCS CONCEPTS

• Applied Computing-E-Government; • Applied Computing-Document Management and Text Processing;

KEYWORDS

Question Answering, Service Innovation, Citizen Services, Text Analytics

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1 INTRODUCTION

The Digital Government Blueprint [1] that the Singapore Government has advocated since 2018 strongly emphasised the need to enhance citizen satisfaction rate by leveraging data and technology to respond to citizens' needs promptly and efficiently. To minimise the impact of COVID-19 on the citizens of Singapore, various COVID-19 initiatives were rolled out by the Singapore Government. This resulted in more incoming inquiries from citizens to respective agencies through telephone, in-person, and email. This surge overwhelmed the Customer Service Officers (CSOs). Creating a government chatbot such as AskJamie to leverage Questioning Answering technology is one of the solutions to increase citizen satisfaction rate [3, 10]. However, such chatbot solutions were unsuccessful due to incorrect and inappropriate answers given to citizen inquiries [17].

A more viable solution is to leverage the concept of applied artificial intelligence (AI), which uses AI to enhance and extend software applications. In this research, applied AI comes in the form of a software system that incorporates question answering (QA) systems to help the CSOs respond to citizen inquiries [4, 9, 13, 14, 16]. QA systems involve the analysis of a question phrased in natural human speech and then locating a recommended answer to that question within a database of documents [2]. CSOs using the QA system would likely reply more promptly and appropriately to the citizens.

With such systems in place, there is potential operational effectiveness that can be achieved within a citizen service setting.

This research paper presents our experience building and evaluating a pilot question answering system - Citizen Question Answering System (CQAS), using the existing case records and documents in a knowledge article database from a government agency. The overarching goal of this research is to elicit the learnings during the initial implementation of a hybrid question answering system (CQAS) that combines techniques of Information Retrieval QA, Natural Language Processing QA and Knowledge-Based QA. The research will further share how these learnings could inform the adoption of QA systems in a government setting.

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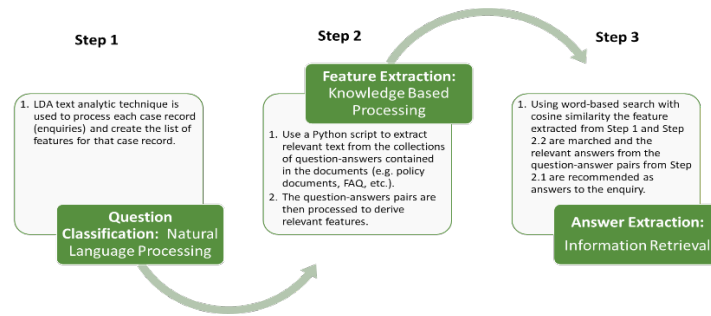


Figure 1: Overview of the Hybrid QA Technique used in CQAS

The contribution of this research is to provide insights into the challenges of the implementation of QA systems within a government agency. The subsequent research following this paper will then focus on conducting a user study with the CSOs to validate further the benefits of this pilot QA system, which is not covered in this paper.

2 METHODOLOGY

2.1 Business Context and Data

The case study was based on a Singapore government agency that uses an external customer service centre that caters mainly to individuals and companies who have inquiries about training-related programmes and initiatives that this agency manages. The citizen sends an enquiry through one of the different mediums such as telephone or email. The CSO inputs the enquiry into CQAS, retrieving a ranked list of relevant answers. The CSO can either select an answer or adapt from the list, which is then sent to the citizen. CQAS uses two types of pre-processed data, namely past inquiries from citizens captured in case records and information from FAQ and other policy documents.

2.2 QA Techniques Used

The CQAS is built using the Hybrid QA technique. Figure 1 depicts the different techniques used.

3 FINDINGS AND DISCUSSION

3.1 Presence of feedback-related statements increased the complexity of CQAS

The pilot QA system had a low accuracy of 33%. It was uncovered that, unlike a chatbot, inquiries submitted by citizens via email or digital feedback portal tend to be lengthy and structured more like feedback than as a question only. Hence if a government agency wants to adopt the QA system, they must investigate ways to enhance the QA system to differentiate feedback-related statements from questions so that the recommended answers can be relevant to what the citizens are looking for [6]. A proposed approach to handling this issue will be through introducing a task for CSOs to manually identify the question being asked or allow the CSOs to read the case and then key in the question instead. This approach might facilitate better accuracy during answer extraction later if the question was elicited correctly [7, 15].

3.2 Review of Typology for Questions that had failed

Additionally, to better understand how the low accuracy of CQAS comes about, we also studied the typology of the questions that had failed to get an accurate recommended answer. Generally, questions can be defined by the type of answers expected. Based on this school of thought, there are four key question types: factoid, list, definition, and complex question [5, 8, 11]. Going by the definition of a complex question about the information in a context and the answer required will likely be a merge of retrieved passages [12]. Many of the case records that had failed to get an accurate answer to fall into this category of complex questions.

4 CONCLUSION

In this paper, using real-world data sets, we presented our experience building and evaluating a pilot QA system, CQAS, for a government agency’s customer service centre. CQAS is a hybrid QA system that combines techniques from Natural Language Process QA, Knowledge-based QA and Information Retrieval QA. Due to the low accuracy of CQAS, we did a deep dive into both the case records and the collections of documents. We presented the following key learnings which can be considered for future research work when further enhancing CQAS QA systems:

Inclusion of a manual question classification mechanism so that CSOs can indicate within the system which part of the case record is a question and thus improve the question classification capability of the QA system.

Establishing a question typology for the failed questions that did not have an accurate answer could be recommended as a reply to citizens. This will help the people developing the QA system further enhance it to cater to the different question types (e.g., ambiguity, poor syntax, etc.) that the CSOs might encounter.

This research contributes to the body of AI applied research in digital government and, more specifically, to QA systems to support CSOs responding to citizen inquiries. Future work will address the learning points discussed and implement them in the future version of CQAS. A user study will also be conducted to evaluate CQAS further.

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