Enhancing Education Process Through Intelligent Association Mining (IAM) System Conversations: Chatbot Services in Educational Settings

Nattha Thongda
Bureau of Academic Administration and Development,
Khon Kaen University, Thailand
natttho@kku.ac.th

Wararat Songpan*
Department of Computer Science, College of Computing,
Khon Kaen University, Thailand
wararat@kku.ac.th

ABSTRACT

Nowadays, chatbots are growth in terms of business, and it is necessary for businesses to implement innovative approaches to repository big data and provide customer service twenty-four hours. Moreover, chatbots system is explored the efficacy and potential of applied services to enhance education through intelligent conversations and AI techniques. The study aims to investigate how chatbots based on intelligent association mining method called IAM can contribute to educational settings by providing personalized and interactive questions and answering. In aspects of cluster are divided into 6 clusters as 1) Enrollment 2) Academic service 3) Student profile 4) Admission 5) Check and tracking grade and 6) Finance. The implementation of enhancing education process through intelligent association mining found out the overall accuracy of answering correctly to 92.16% compared with traditional way was cost human time-consuming investment to answer the question via chat in social media. The benefit of deployed IAM chatbot system used the several of educational services' question in university which is huge number of around 45,000 students per year.

CCS CONCEPTS

• **Computing methodologies**; • **Multi-agent systems**;

KEYWORDS

chatbot, AI, intelligent system, association mining, customer service

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*Corresponding Author: wararat@kku.ac.th.

1 INTRODUCTION

Recently, the integration of artificial intelligence (AI) as intelligence system and chatbot services in education has rapidly gained significant attention after post-covid19. Research begins by examining the current landscape of chatbot services in education, highlighting their capabilities and limitations then delves into the benefits of incorporating chatbots in educational settings, including their ability to provide instant support, facilitate personalized learning, and engage students in interactive dialogue [1]. Furthermore, the study explores the various applications of chatbot services in education, ranging from assisting with administrative tasks to delivering instructional content and offering academic support. In addition, this approach examines case studies and existing implementations to identify successful practices and highlights potential challenges associated with the adoption of chatbots in education [2].

The findings of this research provide valuable insights into the impact of chatbot services in educational settings. They shed light on the potential of chatbots to enhance student learning experiences, promote self-directed learning, and improve access to educational resources [3]. Additionally, the study identifies key considerations, such as data privacy, ethical concerns, and user acceptance, that must be addressed to ensure the successful implementation and adoption of chatbot services in education. To assess the efficacy of chatbot services, the research utilizes a mixed-methods approach [4], combining quantitative analysis of user feedback and qualitative assessment of student experiences. The most data collection process involves surveys, interviews, and user interaction analysis to measure student satisfaction, learning outcomes, and overall engagement.

The purposed intelligence methodology into chatbots by association rules integration can be used together to improve the effectiveness of chatbots. For example, a chatbot that is trained on a dataset of association rules can be more likely to generate accurate and relevant responses to user queries. Additionally, a chatbot that can identify association rules can be used to recommend education processes or services to users based on their past history and expertise's knowledge. Therefore, the contribute of chatbots and association rules can be work as follows:

- A chatbot that is used to provide personalized tutoring can use association rules to identify the topics that a student is struggling with. The chatbot can then focus on providing tutoring on those topics.

- A chatbot that is used to deliver educational content can use association rules to identify the topics that are most relevant to a user's interests. The chatbot can then recommend educational content on those topics.
- A chatbot that is used to provide student service can use association rules to identify the products or services that a student is likely to be interested in. The chatbot can then recommend those products or services to the students.

This paper is structured as follows: Section 2 covers the background of chatbot and related works. Section 3 describes the framework of intelligence association mining. Section 4 gives experimental results of chatbot services setting integrated our purposed models. Section 5 concludes the implementation.

2 RELATED WORKS

2.1 Association Mining

Association Mining acquisition [5] is the acquisition of association rules by finding frequent patterns, called frequent patterns, and the associations that occur of groups of items. In the form of transactions, the results are in the form of association rules. In this research, an algorithm to find correlation rules, the association rule was used. must calculate the support and confidence which are shown correlation between the items to know the relationship between the two items and how much there is a relationship. It has patterns (X, Y) where X and Y can be applied to items or objects as well as we are studying instead of question and answering. The pattern is followed as,

$$X \rightarrow Y \tag{1}$$

Support calculation is the probability of the number of occurrences of a value X with a value Y that is between [0-1]. If the value is close to 1, it means there is a strong relationship.

$$\text{Support}(X \rightarrow Y) = P(X \cup Y) \tag{2}$$

Confidence (Conf) calculation is the probability that the number of value X will always occur with the value Y followed by a sequence of events between [0-1]. If the value is close to 1, it means there is a strong correlation in the order of the items.

$$\text{Confidence}(X \rightarrow Y) = P(X \cup Y)/P(X) \tag{3}$$

Lift is the probability that the number of data values X will always occur with data values Y according to the sequence of data events, which is between [0-1]. If the value is close to 1, it means there is a probability are related in order of large number of items.

$$\text{Lift}(X \rightarrow Y) = \frac{P(X \cup Y)}{P(X) P(Y)} \tag{4}$$

This methodology can solve problems in question-and-answer matching as intelligent system called IAM system which should be applied AI techniques into the chatbot system to be smarter. They are collecting challenge artificial intelligence or AI (Artificial Intelligence) to be able to multiple answer questions. More details than normal chatbots too Chatbot bonus also have other definitions. The AI techniques [6-8] should be integrated to chatbots in education has importance thing to guideline the students.

2.2 Chatbot in Education Setting

Chatbots are computer programs developed to help us automate everything. Real-time characters, images, and sounds which have both normal chatbots and Chatbot AI (Artificial Intelligence) where normal chatbots will only understand keywords. In [2] describes a chatbot that was developed to provide personalized tutoring to students. The chatbot was able to understand natural language questions and provide accurate and helpful answers. The benefits, challenges, and future directions of chatbots in education. In [3] argue that chatbots can provide several benefits for students, such as increased motivation, improved engagement, and personalized learning. However, they also identify a number of challenges, such as the need for chatbots to be able to understand natural language and the need to ensure that chatbots are unbiased. Therefore, the use of chatbots in educational are identified a number of potential benefits of using chatbots in education, such as increased student engagement, improved learning outcomes, and reduced costs. However, they also identify challenges, such as the need for chatbots to be able to understand natural language and the need to ensure that chatbots are unbiased [4].

3 OUR FRAMEWORK

The purposed model for chatbot services in education called intelligent association mining (IAM) which started with data collection for question and answer and interview admin deal with section in 6 main clusters as:

1) Enrollment: is as services aspect of academic calendar, study/exam schedule, course enrollment, course adding/withdrawal/less/more, credit limitation, fee discount, fee deferring.
2) Academic service: is as services aspect of academic documents request, diploma requesting, degree verification, student ID card.
3) Student profile: is as service aspect of student reporting, personal record modification, student registration, academic leave/ student resignation, transfer program, academic appeal.
4) Admission: is as service aspect of admission criteria, admission calendar,
5) Check and tracking grade: is as services aspect of grade, thesis defense examination, transfer credit, check the accuracy of the graduate's information.
6) Finance: is as services aspect of payment, certified copy of the tuition fee receipt.

Firstly, the preprocessing of data collection has many questions and answers and filters only the frequent questions and experts examine the answer as possible to training data. The framework data training is grouped by verify from experience following cluster which shown as Figure 1.

After the expertise collected the frequently question and pre-trained the answer by knowledge's expert exactly. The framework in the next step will be exacted words from the sentence of question by tokenize words into vectors. For example, there are questions are shown as Table 1,

Next, the intelligent association rule will be worked calculation by support, confidence, and lift value. For example, the Q1 as above

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INTELLIGENT ASSOCIATION MINING (IAM): CHATBOT SERVICES IN EDUCATION SETTING
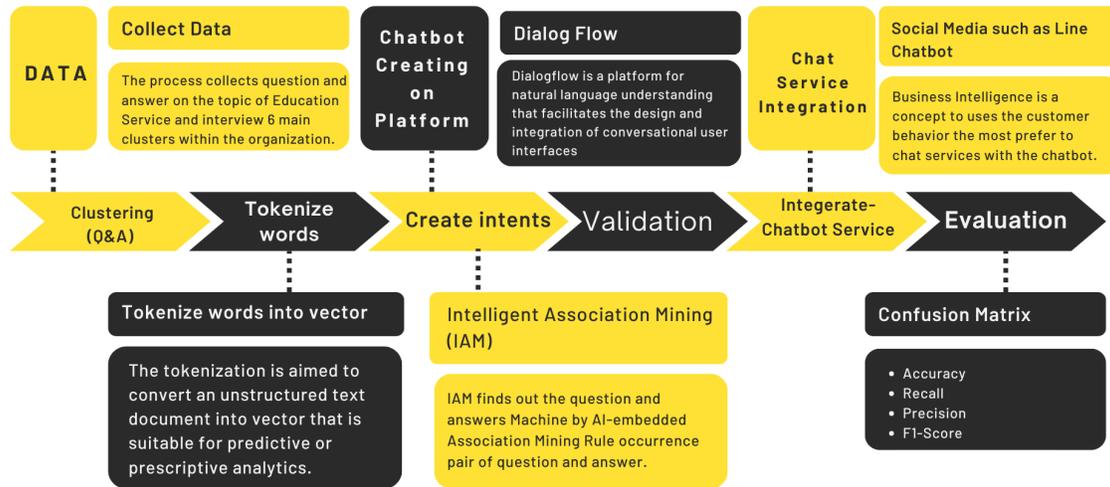

Figure 1: Framework of intelligent association mining (IAM): Chatbot services in education setting.

Table 1: Questions example using the pre-training on intent of chatbot platform.

Questions (Thai)	Questions (English)	Tokenization	Words
Q1: ลงทะเบียนเพิ่มต้องทำอย่างไร	How to add course enrollment ?	How to |***add course***| |***enrollment***|	add course, enrollment, add, withdraw, course
Q2: สวัสดีค่ะ สอบถามเรื่องการขอทรานสคริปหน่อยค่ะ	Hello, Would I like the request transcript document?	Hello, Would I like the |***request***| |***transcript***| |***document***|?	request, transcript, document

Table 2: The best rule example via intelligent association mining.

Questions	Answers	Conf	Lift
Q1 (*add course, enrollment*)	A17 (***add*** and ***withdraw*** by 8-19 August 2022)	(1.0)	(14.75)
Q1 (*add course, enrollment*)	A22 (waiting for extended ***enrollment*** date)	(0.2)	(7.87)
Q1 (*add course, enrollment*)	A12 (press confirm ***enrollment***)	(0.2)	(7.87)
Q2 (*request, transcript, document*)	A5 (You can **request** 3 channels: digital **transcript**, **document**, and counter service)	(1.0)	(7.87)

asks the chatbot "How to add course enrollment. The IAM methodology will calculate the support and suggest multiple answers setting minimum support acceptance was 0.3 if the support was more than 0.3 will be occurrence. Therefore, the advantage of intelligent association mining system will help the creation of intent matching in dialog flow. The best rule example using intelligent association mining are shown as Table 2.

This IAM Chabot is evaluated by metric called confusion matrix which the performance measure examines the validity of the question-and-answer matching. By considering the level of accuracy (Precision) and completeness (Recall) as well as the overall performance of the search (F1-score) according to the following equation 5)-(8).

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} x100 \tag{5}$$

$$Precision = \frac{TP}{TP + FP} x100 \tag{6}$$

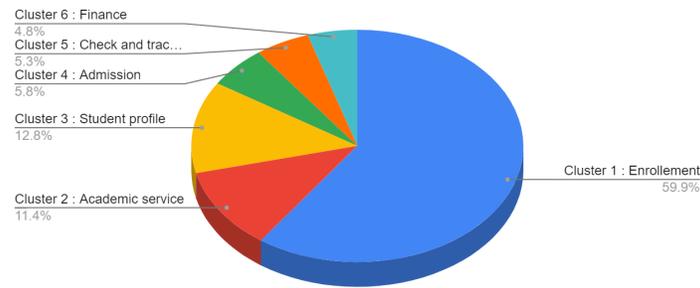$$Recall = \frac{TP}{TP + FN} x100 \tag{7}$$

Figure 2: Pie Chart for test set evaluation

Table 3: Confusion Matrix Performances of intelligence association mining (IAM) chatbot

Actual/Predicted	Enrollment	Academic service	Student profile	Admission	Check and tracking grade	Finance	TP	FP	FN	TN
Cluster 1 : Enrollment	141	7	2	7	4	2	141	40	22	292
Cluster 2 : Academic service	3	86	1	2	2	0	86	41	8	360
Cluster 3 : Student profile	22	24	52	5	3	0	52	4	54	385
Cluster 4 : Admission	5	1	1	40	1	0	40	17	8	430
Cluster 5 : Check and tracking grade	4	3	0	2	35	0	35	10	9	441
Cluster 6 : Finance	6	6	0	1	0	27	27	2	13	453

$$F1-\text{score} = \frac{2*Recall*Precision}{Recall + Precision} \qquad (8)$$

Where,

TP (True Positive) indicates the reliability of the question of cluster i that was correctly predicted answer by the IAM chatbot compared to the actual answer.

FP (False Positive) indicates the reliability of the question of cluster i that was incorrectly predicted by the IAM chatbot compared to the actual answer.

FN (False Negative) indicates the reliability of the question of cluster i that was correctly predicted by the IAM chatbot to the predicted the other answers.

TN (True Negative) indicates the reliability of the question of cluster i that was incorrectly predicted by the IAM chatbot to the predicted the other answers.

This performance is very importance in evaluation IAM model because the IAM chatbot is identify for each cluster. Summarized performance describes by accuracy. The precision is compared predicted answer with TP and FP. In addition, the recall is compared predicted answer with TP and FN. The F1-score describes the average of weighted recall and precision.

4 EXPERIMENTAL RESULTS

The experiment tests integrated to Line official and tracking about the IAM chatbot system, which the dataset which has overall 427 questions records and answer to evaluation in these experimental results. The highest number of asking question that was cluster1: enrolment, student profile, academic service, admission, check tracking grade and finance respectively were shown pie chart in Figure 2.

As Table 3, there are divided into 6 clusters as 1) Enrollment 2) Academic service 3) Student profile 4) Admission 5) Check and tracking grade and 6) Finance. The evaluation of framework via intelligent association mining found out that the cluster 1: enrollment has true positive as 141 question and predicted correctly compare with others. Cluster 2: has true positive as 86 questions and predicted correctly compare with others. Cluster 3: has true positive as 52 question and predicted correctly compare with others. In other hand, the cluster 6: has true positive as 27 question and predicted correctly compare with others which fall to others as enrollment and academic service because these cluster have the function deal with finance as same as cluster 3 student profile has correlated with enrollment and academic.

As Figure 4 show integrated social media as line official because the business intelligence tracking the student prefer line chat, which
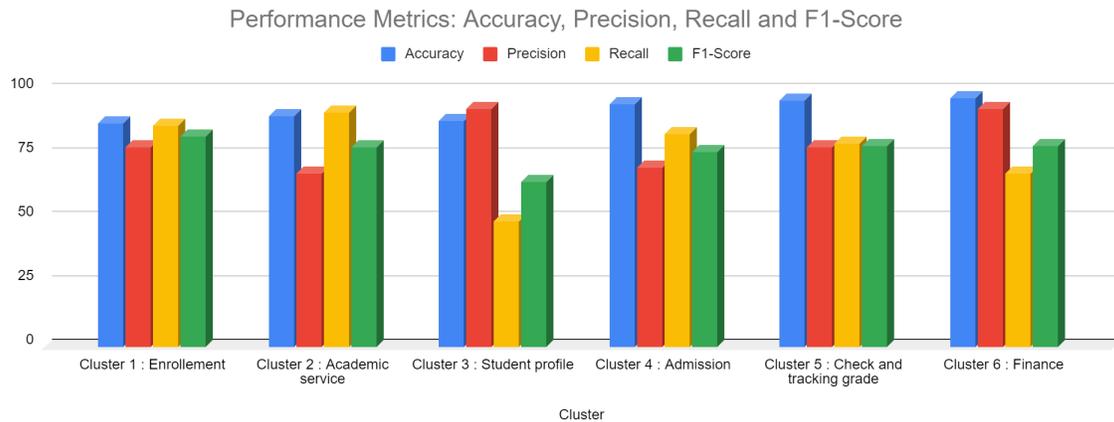
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Figure 3: The comparison of performance metrics of clusters: accuracy, precision, recall and F1-score.

(a) Chatbot traditional way: it is non-integrated with IAM Chatbot framwork

(b) Question Example: Enrollment predicted actual results

(c) Question Example: academic document predicted actual results
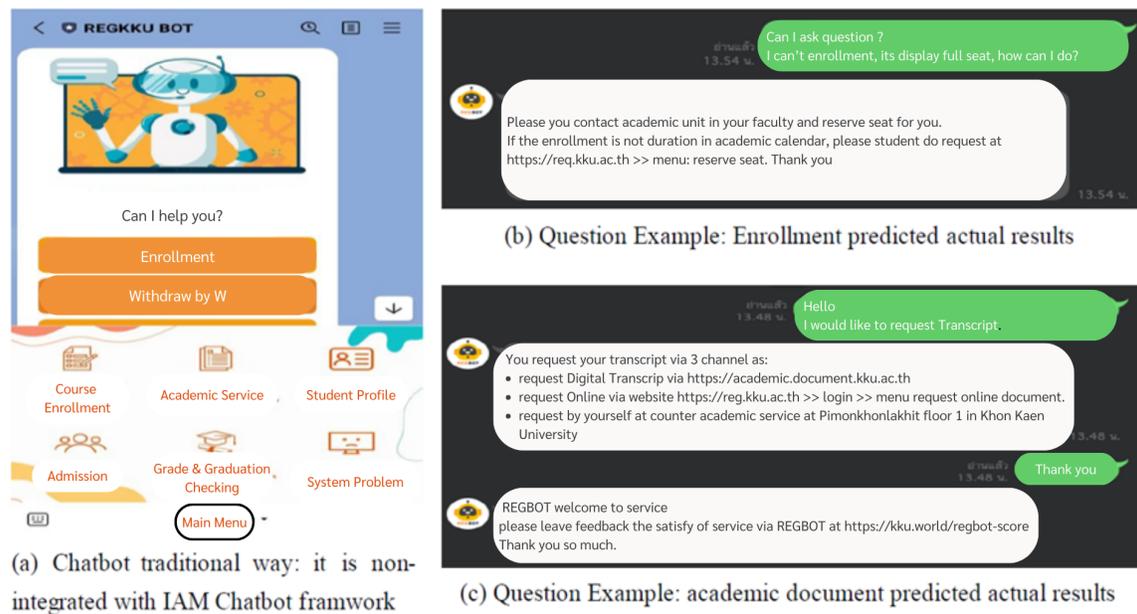
Figure 4: The integrated IAM chatbot framework into Line official.

chatbot in traditional way has only the menu and sub-menu otherwise, students look and feel like robot. However, (a) show the question from student who could ask the question in own sentence and IAM chatbot understanding and answer from pre-train by our framework. As (b) the student asks the problem solving when the academic unit is out of time. The IAM could answer how to solve the problem. Also (c) the student asks about the request documents, IAM chatbot can reply to the answer correctly, the student has satisfied and reply again who do not know to be talking robot. The IAM chatbot will be successful if the IAM are trained in a lot of association patterns.

5 CONCLUSION

Ultimately, this research contributes to the growing body of knowledge on chatbot services in education and provides educators, administrators, and policymakers with evidence-based recommendations for leveraging intelligent conversations to enhance the quality and effectiveness of education in the digital age. We proposed automated answering by using Intelligence association mining into the chatbot enhancement that pre-training has association rule using an AI technique. The IAM chatbot can be worked to filter the question and answer frequently from our framework enhancements. The system applied to real use cases and repository huge number of

questions which estimate the complexity of education process and try to group categories of question and answering questions into 6 main cluster to reduce the various of natural language processing. Moreover, this study reduces cost and process time to use humans to monitor the question came into the system instead of human as conceptual of AI.

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