Academic events are events that are commonly organized in an educational environment such as workshops, seminars or conferences. Finding suitable academic events for researchers, especially novice researchers, is a crucial task. However, the dissemination of information on academic events is still limited. Existing tools are inadequate to provide recommendations based on user needs as these tools have limited functions. Hence, there is a need to develop a recommender system that recommends suitable, relevant and reliable academic events to the researcher. The aim of this paper was to propose a hybrid recommender technique to assist novice researchers in finding suitable, relevant and reliable academic events. This paper presents the architecture for AcadEvent, a recommender system for academic events using a hybrid technique consisting of a search based on Tags and a User Rating. The research methodology was comprised of four stages, namely information requirements, technique development, prototype development, and evaluation. The evaluation results showed that the proposed technique offers a better performance in terms of assisting the researcher in finding suitable and relevant academic events.

Keywords—Academic Events; Hybrid Recommender; Tagging; User Rating

I. INTRODUCTION

For researchers, academic events are important for improving communication skills, gaining expert knowledge, and networking with others. Even though many academic events can be found using existing tools like Workshop Directory [26] and EventBrite [27], the main issue is how to find suitable, reliable and relevant academic events. This is a crucial task for every researcher. However, researchers, especially novice researchers, are facing difficulties in finding such academic events. This is important as the objective of attending such events is to gain knowledge and to obtain good feedback on the works of researchers [2]. There have been very few researches into the recommendation of academic events [2,3]. Ji et al. [3] reported that the current issue with online event recommendations is information overload. The existing tools also face a few limitations such as out-dated event recommendations [25], cold start challenges [31, 8], and the documentation and managing processes for academic event tools, which suffer from several issues in terms of event announcements and unstructured data for academic events [4]. Hence, there is a need to develop a recommender system for academic events.

The objectives of this study were: (1) To develop a hybrid recommender technique to assist the novice researcher in finding suitable, relevant and reliable academic events, and (2) To evaluate the technique. For this work, the academic events were limited to seminars and workshops alone.

II. LITERATURE REVIEW

An academic event, such as a seminar or workshop, provides a platform for researchers to identify and explore new knowledge and information. Academic events are important as they increase knowledge in particular fields from a different perspective. To the novice researcher who is newly involved in the research environment, choosing the right academic events to attend is a challenging issue. If a novice researcher is in the Computer Science domain, he/she may need to attend more events, such as seminars, in order to gain knowledge in a particular field. Choosing the wrong events might result in a waste of time and money. A different perspective and conflict of understanding with regard to their research work might occur after attending the wrong academic research event. This study was aimed at assisting novice researchers in narrowing down their search for suitable, relevant and quality academic events that best fit their needs.

A. Recommender System

A recommender system (RS) is mostly used in e-commerce to present information on items and products that are likely to be of interest to the user (e.g. films, books, news, and web pages) [9]. The RS predicts those items that best match the user's preferences, thereby reducing the user's cognitive and information overload [7]. The recommendations by the RS relate to various decision making processes such as what items to buy, what music to listen to, and what online news to read [12]. There are three types of recommender techniques that are commonly used for developing a recommender system, namely Content-Based Filtering techniques, Collaborative Filtering techniques, that have been divided into Model-Based and Memory-Based Filtering, and Hybrid Filtering techniques [12].

A content-based filtering technique (CB) is a domain-dependent algorithm, and it gives more emphasis to the analysis of the attributes of items in order to generate predictions [13]. CB techniques are mostly known as item-to-item recommendation techniques. In a content-based filtering technique, a recommendation is made based on the user’s profile using features extracted from the contents of the items that have been evaluated by the user in the past [10, 14].

A collaborative filtering technique (CF) recommends items to users according to their preferences. However, CF also suffers
from a few issues such as cold starts, data sparsity, scalability, and so on [15]. It then matches users with relevant interests and preferences by calculating the similarities between their profiles to make recommendations [16].

A hybrid technique is a combination of two or more recommendation techniques (i.e. CB and CF) in order to improve on the limitations of a single recommender technique (e.g. weighting, switching, mixed, feature combinations, cascades, feature augmentations and meta-levels) [14]. One way to implement a hybrid technique is to separately implement the techniques before combining the results, utilizing some CF in the CB technique, and some CB in the CF technique, or to bring both techniques together by creating a unified recommender system [13].

In this study, a search based on tags was chosen and a user rating was taken into account as a model of user interest. An approach that allows users to collaboratively create and manage the tags, annotate and classify their own content for archiving and sharing is known as a Collaborative Tag or Folksonomy [23, 24]. This hybrid technique is applied by separately implementing two techniques to search for information by collecting the tags and modelling the user’s interest, before combining the results to offer reliable and suitable event information to the user [23].

### B. Previous Studies into the Finding of Events

Recommender systems have become the trend for huge companies and websites, like Amazon, that sell products online [21]. Recommendation techniques are used to solve the problem of information overload, which affects a user in the gathering of information [25].

An academic event tool contains a set of components that are related to the information seeking process. The basic process of an information seeking tool is shown in Fig. 1, [17].

![Fig. 1. Basic Information Seeking Tool](image)

The existing tools are insufficient and the academic event management and documentation processes still have limitations in terms of unstructured data and event announcements [4]. Based on previous studies, academic event recommenders are used mostly in social network analysis to recommend events by using several techniques that are graph-based [29], location-based [30] and community-based [4]. However, the focus is general events, rather than specifically focusing on academic events alone [30, 31].

Furthermore, unauthorized websites are not a reliable source of information because there is no authoritative control over what is posted on the websites [6]. Reliable information is important and can deal with uncertainties and complexities [1].

There is an important need for an academic event tool that contains a user rating, feedback and recommendations in order to achieve a better performance in any tool and to gain more visitors or users to their particular websites.

### C. Academic Event Tools

An academic event tool is also known as an information seeking tool for academic researchers to use as a platform for finding academic events such as seminars or workshops [25]. An academic event tool is supposed to provide reliable and updated information about the academic event itself. There are a few existing tools that are related to this study, such as:

- **Workshop Directory** - Workshop Directory is for researchers to find international workshops on art, photography, writing and music. The directory requests the user to search using the category, location, dates and keywords. The output does not allow the user to filter any results. It displays the title of the event, the description, and information about the organizer, and directs the user to third party websites to proceed for further payment [26].
- **Workshop Finder** - Workshop Finder allows the user to search for a workshop within the terms of the date. The user needs to choose using a drop-down list of the types of workshops given. These tools also make the search specific by searching by area postcode and covering a distance of a certain number of miles between the workshop and the stated area. This tool then provides information on the workshop such as the time and date, information on the organizer, and gives the website links to make bookings for the particular workshop. The workshops only cover the health and sports domains and are only for UK citizens [28].
- **EventBrite** - EventBrite is a tool that has wider options to search for events. This website allows a user to search using keywords or tags and also by dates or specific areas. This web tool provides more detailed results such as the event details, date, prices, location, with Google map location service, information about the organizer, and the upcoming new events that have been published in the web tool [27].

Research has shown that none of the existing academic event tools provides a function to give a rating or feedback on the events attended by a participant. On the other hand, event recommendations are a relatively new area. An event is a so-called one-and-only item [18], which makes it harder to recommend them. While other items or products easily remain, an event only occurs at a specific moment in time and place to become irrelevant very quickly afterwards [19]. Relevance, in terms of all the basic needs and functions in an academic seeking tool, were found in these four (4) tools for comparison.
TABLE I. COMPARISON OF MOST RELEVANT ACADEMIC EVENT SEEKING TOOLS.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Search by Keywords</td>
<td>√</td>
<td>x</td>
<td>√</td>
</tr>
<tr>
<td>Search by Domain</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Search by Area/Topic</td>
<td>x</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Search by Dates</td>
<td>√</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Notification for up-coming event</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ranked Search Result</td>
<td>x</td>
<td>x</td>
<td>√</td>
</tr>
<tr>
<td>Search Result</td>
<td>Both</td>
<td>Up-coming only</td>
<td>Up-coming only</td>
</tr>
<tr>
<td>Recommendation for similar events keywords</td>
<td>x</td>
<td>x</td>
<td>√</td>
</tr>
<tr>
<td>User Rating</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Based on Table I, it is important to emphasize that there are limitations to the recommendation techniques used in these three existing tools in finding suitable academic events. Most of the tools use keywords, area/topic, and dates to model the information retrieval in the search. The Workshop Directory retrieves previous events and up-coming events for the user [26]. The user is faced with the difficulty of dealing with multiple sources of information that include unnecessary events that have already taken place and which are being constantly retrieved based on this search. In addition, EventBrite [27] does not use dates for its search model. Thus, the retrieval of events without providing the date is quite challenging to the user, as the user will need to take a long time to find suitable up-coming events based on their preferences. The most common issue in these four tools [26, 27, 28] is the fact that they do not take into account the domain and user rating. Therefore, the event would be retrieved from the area of interest in a specific domain only. This is because the area of interest of the user is widely used in other domains as well. For example, training in qualitative and quantitative methods can not only be found in the domain of mathematics, but also in any other domain such as computer science or education. Furthermore, the user rating, which is not taken into account in the retrieval of the results, can be crucial in assisting in the recommendations to the novice researcher, who is inexperienced in finding academic events.

III. RESEARCH METHODOLOGY

The research methodology for this study consisted of four stages:

Information Requirements Stage - This stage gathered the required information that involved primary studies in identifying the problem, the research scope, and the significance of the research. This stage was carried out by conducting a literature analysis and comparative studies of previous works in this related study.

Technique Development Stage – The proposed technique was developed. The components to develop the architecture, flow process and mechanism were implemented and identified in this stage.

Tool Development Stage - The development of the AcadEvent was carried out in this stage. The Rapid Application Development (RAD) method was chosen to develop this tool. This is because the RAD reduces the cost and time for the delivery of the tool. The RAD structure consisted of the requirement planning, user design, rapid construction and cutover [20].

Evaluation Stage - The final stage involved conducting the evaluation. In this stage, the proposed technique was evaluated using the precision and mean average precision. The precision was used to determine the relevancy of the proposed technique, while the mean average precision was used to evaluate the retrieval results.

IV. ARCHITECTURE OF ACADEVENT

This study proposed a tool, AcadEvent, as a recommender system for academic events. The architecture of the AcadEvent is shown in Fig. 3. The main components of the architecture are:

- Input: Receives input from the participant and organizer.
- Process: This component contains four main components, which are the User Profile, Search or Feedback, Event Profile and Recommendation Component.
- Output: Consists of retrieved results from the Process Component.
- Database: Contains three main tables which store the Participant information, Organizer information, and Event information.

The architecture is shown in Fig. 2.
The frequency of the Total Tags that appeared will be accumulated as the “Highest Tags (HT)” results. The Recommender Component process is shown below, where Fig. 3, shows the pseudocode for the recommending of events in AcadEvent.

**Input:** Set KT which contains keywords or tags, \( p \) as a user profile with profile and \( ed \) as the event database.

**Output:** Set ER as the set of events rated and RER as the set of recommender event results.

1. **Begin**
2. **For** \( p \) search query input for keyword or tag, \( KT \in ed \)
3. **For** each keyword or tag, \( KT \) in event database, \( ed \)
4. **Search** with KT being tagged with similar tags in \( ed \)
5. **For** all highest tags (HT) being tagged in \( ed \)
6. **If** \( (HT \text{ date} > \text{ current date}) \)
7. **Add** in list of highest tags, \( LHT \leq 20 \)
8. **Rank** the \( LHT \) event based on highest rating, \( LHT \in ER \)
9. **Recommended** event based on Tags and Rating, \( RER \)

Example: The frequency of tags in each Event Title and Event Description was marked, as in Table II, to show in which events the most tags appeared. The frequency was calculated by adding how many tags appeared in the Event Title with how many appeared in the Event Description.

1. Tag4 occurred in Event1 Title = 2 times;
2. Tag4 occurred in Event1 Description = 3 times;
3. Total occurrence of Tag4 in Event1 = 5 times.

**TABLE II. EXAMPLE OF FREQUENCY OF TAGS THAT APPEARED IN EVENTS**

<table>
<thead>
<tr>
<th>Tag1</th>
<th>Tag2</th>
<th>Tag3</th>
<th>Tag4</th>
<th>Tag5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Event2</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Event3</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Event4</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Event5</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
TABLE III. THE DISPLAY RESULT WILL BE RANKED BY THE AVERAGE RATING WITH THE HIGHEST ON TOP AND THE LOWEST AT THE BOTTOM

<table>
<thead>
<tr>
<th>User Rating</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1Ev3</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>D1Ev1</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>D2Ev1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>D4Ev2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>D5Ev1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

|   | Average Rating will be used to rank the display results of TOP N recommendation for AcadEvent |

Table III shows an example of the user rating frequency based on the “Highest Tags (HT)” and the average user rating. For an up-coming event, a user rating can hardly be obtained as the event will be in the future, but the user rating is based on the rating of the speaker plus the event rating. Some events might be a repetition and some events are known to have very good speakers. The rating scale was 1 for the “least liked by user”, to 5 “most liked by user”. To rank the TOP N recommendation results, the average rating was used. The average rating was used to determine the highest rank for the recommendation.

C. Output Component

The recommended events and search query results will be displayed in the Output module. Researchers can give ratings to the attended events and speakers, as shown in Fig. 4.

D. Database Component

The Database module contains three tables that store the information from the Input module in the Participant Table, Organizer Table, and Event Table.

V. EVALUATION

This section describes the evaluation of the proposed technique. The precision and mean average precision were used to evaluate the proposed technique since these were widely used in the top-n recommendation items [11].

The precision was measured by the ratio of the recommended academic events that were most relevant to the user. AP@n calculated the mean average precision of all the precision metrics among all users. The larger the value, the better would be the relevancy of the recommendation towards the user. A comparison between the proposed system and the baseline system was used to measure the precision and mean average precision. Table IV shows the precision and mean average precision for an AcadEvent dataset and a baseline system dataset, namely, EventBrite, which was chosen since it was closely related to this study. The precision of the non-rated items, which were regarded as irrelevant, was computed as the top-10 recommendation items.

Table IV shows the values of AP@n AcadEvent and Best AP@n. The results of the evaluation of these will be described in Section VI.

VI. RESULTS AND DISCUSSION

Information retrieval which considers previous academic events, where the academic events are already over, is unnecessary since academic events are continuously being conducted in a short time [23]. The results of the evaluation are summarized in Table IV. Thus, it was shown that the proposed technique in AcadEvent achieved a greater mean average precision (>0.5) compared to EventBrite. This means that the recommendation technique that presented the top-10 list in AcadEvent to the user is a good and relevant prediction technique. It can be concluded by the Best AP@n in the proposed system provided more relevant recommendations to the user in the retrieval of the results.

In this study, a new academic event tool with a recommendation system was proposed by taking into account the user, organizer, speaker, tags used and domain. The combination of a search based on tags and user rating was one of the methods used to recommend the events that were suitable and relevant to the user.

In addition, this technique can assist users to find the events based on their research interest inside other domains which may not be recommended. Therefore, it can reduce the challenge faced by the user in finding the targeted or suitable new academic event and, at the same time, it can lead to a more beneficial and relevant academic recommendation.

VII. CONCLUSIONS

This study highlighted the need for recommendations for academic events to help researchers enhance their knowledge as the existing tools are inadequate for this purpose. Based on the proposed technique, this study developed AcadEvent, a recommender system for academic events that helps novice researchers to find suitable and relevant events within their area of interest. This study proposed a hybrid recommender technique using a tag-based search and a user rating to
recommend an academic event. The proposed tool that was demonstrated in this study is able to recommend relevant academic events to novice researchers to assist them in finding suitable events based on their preference. The usefulness and relevancy of this tool were evaluated using the precision and mean average precision. The evaluation results showed that the hybrid approach used in AcadEvent has better relevancy in terms of recommending an academic event to the user. This can assist novice researchers in identifying suitable and relevant academic events, and to choose the events that best fit their needs. In future, this study can be improved by embedding an adaptive rating.

REFERENCES


