**CHAPTER 1 : INTRODUCTION**

In the age where the internet is the leading source of information recommendation systems are very common to be seen because of the abundance of data that is available. In this Research the author researches the currently available book recommendation systems and tries to find a improvement that can be done to significantly improve the performance of the system. This document will discuss the identified problem, the significance of the research idea, the steps taken to approach the research, a review of existing work and the milestones and date of deliveries of the project.

1. **Problem domain**
   1. **NLP and Sentiment analysis**

Natural language processing (NLP) is one of the core branches of machine learning that uses models to understand and analyze human language in depth. This technology is widely used in text to-speech, google assistant, text analysis to name a few. Sentiment analysis is one of the sub-branches of NLP where use cases for such a technology can be seen in the Amazon or eBay product recommendation system where it processes our likes and dislikes of certain products and recommends items, we are more likely to be interested in. This technology is further used in analyzing online reviews on certain products and predicting the customers emotion towards that certain product.

* 1. **Recommendation Systems with Sentiment Analysis**

Recommendation Systems are very common in the current age of the internet, recommendation systems at the base level use multiple filters to filter data based on many factors such as the likes and dislikes of a user and give a recommendation of something the user may like (Huang, 2022). Systems such as these can be seen done on a large scale such as google ads which show ads of things the user searched previously on social media (Edelman Michael Ostrovsky Michael Schwarz et al., 2005), further streaming services such as Spotify recommends songs or playlists according to the users likes or dislikes uses a combination of machine learning and sentiment analysis (Anderson et al., 2020).

* 1. **Problem Definition**

With the abundance of data users produce on the internet daily gives an opportunity for machine learning models to analyze the data to reveal patterns that couldn’t be seen before. Reading books in general, can be a very effective way to spend time or to learn new things , books sometimes have stories or information that is not readily available on the internet, books can also be a kind of therapy to brighten up the mood, but choosing a book can often be a daunting task for beginners because of the abundance of genres that are available for books, from the past surveys that have been done to understand the attitude of people towards reading 60% of the people replied positively (Fujimoto and Murakami, 2022) . The Current research done for book recommendation systems goes over the use of sentiment analysis to identify the user’s mood using their past social media activity and use that information to find a related book (Fujimoto and Murakami, 2022), in the current system there is room for improvement with the introduction of complex emotions and a machine learning model which could yield more accurate results than the current system.

* + 1. **Problem Statement**

The existing book recommendation system (Fujimoto and Murakami, 2022)could benefit in increasing accuracy by implementing complex emotions and a machine learning-powered recommendation system.

* 1. **Research Motivation**

In the modern era where technology and social media are a part of the day to day life the author believes that taking a break from social media to read a book could be the perfect way to relax for a lot of people, due to the time it takes to find a book someone likes people drift away from reading, an improved book recommendation system could be the perfect solution for people trying to find a book they like.

# Existing work

|  |  |  |  |
| --- | --- | --- | --- |
| **Citation** | **Brief Description** | **Limitations** | **Contribution** |
| (Fujimoto and Murakami, 2022) | A sentiment analysis powered book recommendation system. | The analysis is done on a limited number of emotions. | An effective sentiment analysis power book recommendation system. |
| (Huang, 2022) | A Deep Learning powered recommendation system. | Low accuracy that could be improved. | Improved results compared to traditional algorithms. |
| (Kurmashov, Latuta and Nussipbekov, 2016) | A book recommendation system that gives fast qualitative recommendations. | Low accuracy of results. | Fast book recommendations. |
| (Sariki and Kumar, 2018) | A book recommendation system that recommends book according to the named entities present in the books. | The Efficiency could increase in the ranking method. | Ability to recommend books according to the named entity, ability to generate character lists of a book. |
| (Pera and Ng, 2011) | A book recommendation system that recommends books based on the user’s social media friend’s interest in books. | Relies solely on social media friend list data to give accurate results. | Outperforms the recommendation systems of Amazon and Library Things. |

**1.6 Research Gap**

After reviewing the existing literature, a handful of implementations of book recommendation systems were discovered. Implementations of a book recommendation system can be seen that centers around providing fast recommendations with minimum input data but yields slightly inaccurate results (Kurmashov, Latuta and Nussipbekov, 2016) , a problem that can be seen in this system is the priority of speed over accuracy in a book recommendation system, where low accurate results could affect in users disliking the book recommendation. Books in general, take time to read and people and most people spend only around 3.5 hours a week on average(Fujimoto and Murakami, 2022). In this Book recommendation system research (Fujimoto and Murakami, 2022) the paper talks about the use of sentiment analysis in finding the user’s emotions and recommending books according to the emotion, an improvement in the existing can be done by adding a machine learning model for the book recommendation system and introducing complex emotions apart from the basic happy and sad emotions (Li, Li and Jin, 2020), this could be taken as a gap in research that could be further explored.

**1.7 Contribution to the Body of Knowledge**

Here we will be looking at the contributions this project will be doing to the existing work that has been done in the domain of recommendation systems.

**1.7.1 Technological contribution**

The current book recommendation system (Fujimoto and Murakami, 2022)depends on basic human emotions to give recommendations such as happy and sad, the result accuracy can be further improved using a variety of more complex emotions such as laughter, panic, joy, etc. (Li, Li and Jin, 2020). The recommendation system the current system uses a basic sentiment analysis system, but this could further improve if a machine learning model is used in combination with the standalone sentiment analysis model. The new model the author is proposing will yield higher accurate results compared to the currently existing models the new model will be having the capacity to update with any new book genres.

**17.2 Contribution to the research domain**

This research will directly contribute to the domain of computer science. Due to the increased accuracy and ease of use the new book recommendation system proposes this could attract non-readers and even readers to read more books which could inspire recommendation systems to be used in other fields of research, more research into recommendation systems could lead into the creation of less resource intensive and accurate models which could greatly benefit the domain of computer science and machine learning.

**1.8 Research Challenge**

This research project will be actively using machine learning recommendation systems and sentiment analysis. Recommendation systems have widespread use in many parts of the online advertisement industry such as google ads, YouTube ads, Spotify ads, amazon recommendations, etc.(Anderson *et al.*, 2020). Sentiment analysis has a good track record of being used as a good marketing tool to find complex patterns in what the user likes and dislikes. A few decades prior machine learning involved calculations were done on very powerful large-scale supercomputer but will the passing years it has been possible to execute and train machine learning models in an average laptop computer, even will a huge arsenal of tools available today working and producing effective results with a machine learning model still holds complexity hence some of the possible challenges the author has discovered has been listed.

* Finding or creating a viable dataset that contains updated and enough data of books to satisfy the machine learning model to produce satisfactory results.
* Designing a machine learning recommendation model to work in conjunction with the sentiment analysis model.
* Finding appropriate language and libraries for the machine learning model and GUI.

**1.9 Research question/s**

**RQ1:** What are the problems faced by the existing book recommendation system?

**RQ2:** In what ways does the new system increase the speed and efficiency of the existing system?

**RQ3:** What kind of technologies/algorithms are used in the existing model?

**RQ4:** What are the design improvement that can be made in the new system?

**RQ5:** What testing methods will be used when testing the system?

**1.10 Research Aim**

*This Research aims to design, develop, test and evaluate a system that recommends books by taking the users past activity on social media using sentiment analysis to find the users mood and giving recommendations of books powered by a machine learning model.*

This research aims to design a system to recommend books to users with an up-to-date sentiment analysis model to find the users mood this information will be extracted from the users past social media activity. The recommendation system will be done using a machine learning recommendation algorithm which would recommend books from a premade library of books.

The Proof of concept for this research will be done by involving real users extracting their mood from their past activity and manually evaluating if the book recommendation they got is of their liking, this will help us evaluate if the system if performing up to expectations.

**1.11 Research Objective**

|  |  |  |  |
| --- | --- | --- | --- |
| **Research Objectives** | **Explanation** | **Learning Outcome** | **Research Questions** |
| Problem Identification | Identifying a problem that haven’t been addressed and needs to be solved.   1. Research the current book recommendation system domain and identify any viable problem. 2. Research and find how big the problem is and the scale of the problem is. 3. Research what technological improvements that can be made in the new system. | LO1, LO4 | RQ1 |
| Literature Review | Reviewing the existing literature and finding any gaps.   1. Analyzing and reviewing the existing model for any effective improvements that can be made. 2. Understanding the size and effectiveness of the gap. 3. Hypothesizing the effectiveness of the proposed system compared to the old system using existing literature. | LO1, LO4, LO3, LO6, LO8 | RQ2 |
| Data Gathering and Analysis | Gathering the required data needed for running the model.   1. Analyzing the proposed model and collecting the needed datasets. 2. Reading and understanding relevant sources of information if the datasets are being created. 3. Reading existing papers related to book recommendation systems to find the procedures they took to find data or create. 4. Collecting the needed frameworks and libraries. | LO2, LO3, LO6 | RQ3, RQ1 |
| Research Design | Making the blueprint of the proposed system.   1. Designing the blueprint of the system to collect the user’s activity. 2. Designing the blueprint of the recommendation model. 3. Designing the blueprint of the user emotion detection model. 4. Designing the blueprint of the GUI. | LO3, LO2, LO4 | RQ4 |
| Implementation | 1. Coding and implementing the system from the blueprints. 2. Creating the system for collecting user activity from social media. 3. Creating the book recommendation model with the machine learning model. 4. Creating the model to give the emotion of the user from the retrieved user activity. 5. Training the machine learning model with the dataset. 6. Creating the GUI. | LO2, LO3,  LO5, LO7 |  |
| Testing and Evaluation | Testing and benchmarking the final prototype.   1. Creating testcases for every functionality present in the system. 2. Testing the system on mock data and in real-world data with users. 3. Evaluating if the model is performing up to expectations and tuning it accordingly. | LO4, LO2, LO8 | RQ5 |

*Table 2-Research Objectives (Self-Composed)*

**1.12 Project Scope**

**1.12.1 In-scope**

* A system that recommends books using the users past online activity.
* Adding a machine learning model to the old model that only uses sentiment analysis.
* Factoring in complex emotions to the already existing simple emotions such as happy, sad and neutral.
* Creating a system that collects the activity of the users in one type of social media.
* Having a large but limited library of books to use in the process of the machine learning model.
* GUI interface for the user to interact with to get recommendations.

**1.12.2 Out-scope**

* Additional advanced complex emotions for the sentiment analysis.
* Having all the books that have been published in the library.
* Machine learning recommendation algorithm that autotunes according to the users likes and dislikes of the previous recommendations the user got.
* Creating a less resource-intensive model and application.

**1.12.3 Diagram showing prototype feature**

Diagram

Description automatically generated

*Figure 1-Prototype feature Diagram (Self-Composed)*

**1.13 Resource Requirements**

With the size and scope of the project the resource requirements the identified requirements are listed, and the unidentified requirements are hypothesized as software, hardware, data and skill requirements.

**1.13.1 Software Resources**

* **Microsoft Word** – all the documents are created and exported from word.
* **Mendeley** – Citation management software to keep track of research papers, used in MS Word as a plugin.
* **IntelliJ IDEA/ VS code** – Will be used as the 2main IDE for coding the implementation.
* **Python** – Will be used as the main tool to clean, train and run the machine learning models with many available python data science frameworks.
* **React JS**- Will be used as the tool to design the frontend GUI application.
* **Java** – Will be used with spring boot framework to run REST API.
* **Gradient/Google Colab** – will be used as a cloud platform to train the ML models in case of a resource limitation.
* **Operating System (OS) Windows 10**- All the software and final prototype will be made and tested on the windows 10 system with a OS build of : 19045.2130.

**1.13.2 Hardware Resources**

* **Core i7 4th gen or higher** – To run and train large data sets with machine learning models.
* **8GB ddr4 dual channel memory** – To manage resource-intensive workload of the ML models.
* **20GB or more disk space** – A relatively large amount of space will have to be dedicated to datasets, code, resource material, models and training data including code for the front-end GUI application.

**1.13.3 Data Requirements**

* **Twitter data** -Data from Twitter API will have to be extracted.
* **ML model data**- Kaggle datasets, datahub.io or google open-source datasets related to books will be needed.

**1.13.4 Skill Requirements**

* Prior knowledge working with python and its machine learning frameworks.
* Basic knowledge of front-end application development in react.
* Knowledge in sentiment analysis and machine learning recommendation systems.

**Chapter 2 : Literature Review**

**2.1 Chapter Overview**

Recommendation systems are very widely used in the industry in the forms of ad recommendations systems , product recommendation systems in online shopping apps. Current Book recommendations systems are very hard to come by and lacks consistency when outputting results and is constantly researched to improve the final results. This chapter will go in-depth and critically evaluate the problem, existing work, technological approaches and methodology for book recommendation system.

**2.2 Concept map**

**2.3 Literature review of the problem domain**

**2.3.1 Issues related to finding books**

Books have been the main method of storing and reading information for centuries, books were used to store stories and novels to storing academic and general important information. Books can be divided into many different categorizes and genres which end up creating multiple categorizes with multiple different genres. With almost a abundant number of books to choose from in the past few years the casual novel readers are having trouble picking a book that is of their taste, which ultimately makes new and existing causal reading to move away from book reading.

**2.3.2 Introduction to NLP and recommendation systems**

Natural Language processing also known as NLP which involves making the computer understand human language in the forms of speech or text. With the use of NLP in recommendation systems services such as amazon product recommendation systems we can see the use of NLP taking the frequent search terms and recommending products according to that.

**2.3.3 Text-based sentiment analysis**

Sentiment analysis is the use of NLP to find the sentiment value or a emotion type in a piece of text. By analyzing text data the algorithm will give a score of –1,0,1 which represents the negative emotion with –1 , neutral emotion with 0 and 1 with positive emotion.

**2.3.4 Book recommendation system using sentiment analysis**

The book recommendation system will use machine learning and sentiment analysis to recommend books to the user according to their preferences which is acquired through their motions using sentiment analysis.

The proposed system will acquire the emotions through the users type history and give a sentiment value to the words in the type history, which then will be used to find a book fitting that certain category of emotions which will be acquired from a limited database of pre-existing books will be displayed to the user. With the use of machine-learning in the recommendation system will prove to output quality results.

**2.4 Literature review on existing work**

A handful of research has been done regarding book recommendation systems. The core parts of this book recommendation system is the***user’s emotion extraction*** and the ***recommendation system***. The author will go through the existing systems related to book recommendation systems and find improvements that can be made on the existing system to favor a better output.

**2.4.1 Identifying users’ preference using social media data**

Identifying user's emotions is the first step of the system, this requires accessing the users past social media history and extracting keywords they have used often which could be from a text post for processing. The users social media data is put through a sentiment analysis model and the key words from the text post is taken as values to evaluate the emotion of the sentence.

Text

Description automatically generated

The above example shows the sentiment analysis results done on the NLTK (natural language tool kit) model showing the stat distribution between negative, positive and neutral which can be used to evaluate the emotion or mood of the sentence.

(Maryam Hasan, Elke Rundensteiner, 2014)has worked on a system called EMOTEX which is solely purposed to find emotions in twitter messages, they plan to include a wide variety of emotions apart from the 3 common emotions(happy, sad , neutral) covering complex emotions such as depression, stress and anxiety. EMOTEX also consider the scalability of the system from health care professions to educational institutes. They considered using a model which contains the different emotional states of humans know as Circumplex model To start off they collected labelled test data from twitter with the help of the twitter API the data was imported and classified using hash tags e.g. #sad , #happy, #nervous and any data with multiple or mixed emotions was removed from the training data to not confuse the training model and to keep the accuracy higher. Emojis are widely used in social networks and they have a considerable impact on the emotion detection of the text and emojis is to be considered when training the data according to this study. For testing multiple classification models were used such as Naive Bayes, Decision Tree, SVM, and KNN among these model SVM managed to achieve the highest accuracy.

(Le and Nguyen, 2015)This study aims to investigate twitter data and conduct sentiment analysis and machine learning related tests on the twitter data they acquired from twitter API, classification models such as Logistic regression, Naive Bayes classifier, Random Forest and SVM are used in this study . the most accurate results came from the logistic regression model with features from count\_vectorizer according to this study.

**2.4.2 Machine Learning based user recommendation systems.**

With the vast expanse of data in the current society data sets have got larger in size making it harder to analyze without the use of computers and algorithms. A recommendation system is a type of information filtering system that provides personalized recommendations to users. The recommendations are generated based on a user's past behavior and preferences, as well as the behavior and preferences of other users. There are two main types of recommendation systems: collaborative filtering and content-based filtering. Collaborative filtering systems recommend items based on the past behavior of similar users. They compare the preferences of a user to other users who have similar preferences and suggest items that those similar users have enjoyed. Content-based filtering systems, on the other hand, recommend items based on the characteristics of the items themselves. They compare the attributes of items that a user has liked in the past to the attributes of other items, and suggest items that are similar to those the user has liked.

(Fanca *et al.*, 2020) this paper talks about the two common filtering methods content based filtering and collaborative filtering methods and compares their performance with MovieLens20M database which contain 20 million records of movies. The results show that collaborative filtering shows a better output, but a hybrid approach shows better positive improvements.

**2.4.3 Comparing existing book recommendation systems.**

**Chapter 3 : Design**

* 1. **Chapter Overview**

This chapter

**Chapter 4 : Implementation**

* 1. **Chapter Overview**

This chapter is going to cover the initial prototype implementation of this research. The technological stack, datasets which will be used in the implementation will be described in depth. The reasons for choosing the programming languages and IDE’s will also be explored, at last the implementation of the core functionality will be gone through in depth.

* 1. **Technology Selection**
     1. **Technology Stack**

The technological stack is going to explore the front end, back end and database technologies. The database tier acts as the storage or repository for the code of the implementation which is GitHub to store the code and google drive to store data set related data and SQL will store data related to the implementation. Back end contains python the main programming language of the implementation with python frame works which are pandas, twitter API’s ,and NLTK frameworks. The front end done by postman which acts as a way to interact with the prototype application and python and html is used to show a visual representation of the implementations.

Graphical user interface

Description automatically generated

* + 1. **Data Set Selection**

The data sets are a crucial part of any machine learning related study, this is the data which is ultimately used to train the machine which for this reason the data needs to be as accurate as possible and needs to contain a sufficient number of records for higher accuracy of the model. The data set used in this project needs to have a reasonable size for better accuracy and the data in the data set needs to be from a credible source or the data needs to be proven as valid.

**Book data set-** The book record dataset needed for this implementation was taken from two sources Kaggle’s and GitHub , both data sets contain the book\_name and ISBN which are needed as a part of the implementation ISBN is a unique identifier than a book is published by and having access to a books ISBN gives us information about the author , publish date, genres and a short summery of the book. Both data sets combined gives us about 60,000 + records after all the datasets are cleansed.

* + 1. **Development Frameworks And Libraries**

Frameworks are essential in developing and testing a machine learning related project, frameworks allow preexisting functions and methods to be called boosting productivity.

**Pandas –** pandas is a very important tool in cleansing and managing a data set, this framework gives a variety of tools to manipulate large datasets and pandas also include multiple build in tools to visualize and analyze data.

**NLTK –** nltk which is also know as natural language tool kit is a python library used for working with human language data. It provides a wide range of tools and resources for processing and analyzing text, including tokenization, stemming, named entity recognition, and sentiment analysis.

* + 1. **Programming Languages**

When selecting a language for a machine learning study there are some key factors that needs to be considered .

* Compatibility with the front-end technologies
* Compatibility with the back-end technologies
* Availability of needed frameworks
* Efficiency of coding and execution

With the above factors in mind the most compatible language for above scenarios is python with many machine learning related frameworks existing like pandas, NLTK and the existence of many learning resources related to machine learning ,python this was considered the best option. Python is the most used data science programming language that is currently available due to the abundance of frameworks efficiency of code execution and its vast compatibility with other front end applications python proves beneficial as a language in this study.

* + 1. **IDE**

In this implementation two IDE’s will be used one for the back end and machine learning part and one for the front end webpages.

**IntelliJ IDEA –** IntelliJ PyCharm by JetBrains will be used for the backend. This ide provides dedicated support for python projects provides many useful extensions to make the coding easier, this ide also have support to automatically download libraries without having to manually download them using command lines.

**Visual Studio Code –** Visual studio code will be used to code the front-end web page related part of the implementation. Visual studio provides a simple user friendly interface for anyone working with html and JS related code. Visual studio has a variety of community made plugins to make coding easier.

* + 1. **Summary of Technology Selection**

|  |  |
| --- | --- |
| **Component** | **Technology** |
| IDE | Visual studio code, IntelliJ IDEA |
| Programming language | Python, html, JS |
| Framework and Libraries | Pandas, NLTK, Tweepy |
| API’s | Twitter API’s, Google API’s |

* 1. **Implementation of the Core Functionality**

**4.3.1 Importing tweets from twitter API.**

**Text

Description automatically generated**

Graphical user interface, text, website

Description automatically generated

The first process of this implementation is to get the tweet of a specific user, with the help of the twitter API and the Tweepy framework this is done by initializing the twitter API in python and calling by the user @ which is entered into “user =” after execution of the code the most recent 5 tweets will be called , the amount of recent tweets called can be changed by adjusting the “Limit =” parameter with a integer value.

**4.3.2 Reading the sentiment of the tweet.**

Graphical user interface, application

Description automatically generated

Text

Description automatically generated

With the tweets extracted from the user , the text data can now be put through the sentiment analyzer by python NLTK frameworks. Firstly the sentiment analyzer is initialized and the text tweet is put in the parameters, this gives us a stat distribution of the tweet, the highest value of one stat can determine the dominant emotion of the tweet.

* + 1. **Getting books using google API.**

**Text

Description automatically generated**

To get a book according to the users emotion the google API’s are called and details related to the book such as author, publish date, summery can be extracted by just giving the title of the book or ISBN code of the book, which becomes important in the recommendation part of the implementation.

* 1. **Chapter Summary**

This chapter covered the implementation part of the project in depth exploring the languages, ide’s and frameworks this project is going to work with. The core functionalities of the code is also explored with example screen shots. From the initial project proposal the prototype has undergone changes such as the front end which will be running on a web page compared to the initial plan of running on a mobile application. The initial sentiment analysis model was decided to be VADER models but was changed to NLTK frameworks with was compared to be better with testing, some positive improvements has been considered such as a improved UI on the frontend webpages than what was initialized proposed and if the proposed implementation is completed before the planned time constraints further improvements will be considered.

**References**

Anderson, A. *et al.* (2020) ‘Algorithmic Effects on the Diversity of Consumption on Spotify’, in *The Web Conference 2020 - Proceedings of the World Wide Web Conference, WWW 2020*. Association for Computing Machinery, Inc, pp. 2155–2165. Available at: https://doi.org/10.1145/3366423.3380281.

Fanca, A. *et al.* (2020) ‘Recommendation Systems with Machine Learning’, in *Proceedings of the 2020 21st International Carpathian Control Conference, ICCC 2020*. Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ICCC49264.2020.9257290.

Fujimoto, T. and Murakami, H. (2022) ‘A Book Recommendation System Considering Contents and Emotions of User Interests’, in. Institute of Electrical and Electronics Engineers (IEEE), pp. 154–157. Available at: https://doi.org/10.1109/iiaiaai55812.2022.00039.

Huang, G. (2022) ‘E-Commerce Intelligent Recommendation System Based on Deep Learning’, in *2022 IEEE Asia-Pacific Conference on Image Processing, Electronics and Computers, IPEC 2022*. Institute of Electrical and Electronics Engineers Inc., pp. 1154–1157. Available at: https://doi.org/10.1109/IPEC54454.2022.9777500.

Kurmashov, N., Latuta, K. and Nussipbekov, A. (2016) ‘Online book recommendation system’, in *Proceedings of the 2015 12th International Conference on Electronics Computer and Computation, ICECCO 2015*. Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ICECCO.2015.7416895.

Le, B. and Nguyen, H. (2015) ‘Twitter sentiment analysis using machine learning techniques’, in *Advances in Intelligent Systems and Computing*. Available at: https://doi.org/10.1007/978-3-319-17996-4\_25.

Li, Z., Li, R. and Jin, G. (2020) ‘Sentiment analysis of danmaku videos based on naïve bayes and sentiment dictionary’, *IEEE Access*, 8, pp. 75073–75084. Available at: https://doi.org/10.1109/ACCESS.2020.2986582.

Maryam Hasan, Elke Rundensteiner, E.A. (2014) ‘EMOTEX: Detecting Emotions in Twitter Messages’, *Proc. ASE BIGDATA/SOCIALCOM/CYBERSECURITY Conference* [Preprint].

Pera, M.S. and Ng, Y.K. (2011) ‘With a little help from my friends: Generating personalized book recommendations using data extracted from a social website’, in *Proceedings - 2011 IEEE/WIC/ACM International Conference on Web Intelligence, WI 2011*, pp. 96–99. Available at: https://doi.org/10.1109/WI-IAT.2011.9.

Sariki, T.P. and Kumar, B. (2018) *A book recommendation system based on named entities*, *Annals of Library and Information Studies*.