Modeling the Position of Using the Tourism Relationship Management System (TRM) Adopting Artificial Intelligence Methodology

Mohammadali Hojjatitalemy

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Approval of the Institute of Graduate Studies and Research

Prof. Dr. Ali Hakan Ulusoy
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science in Tourism Management.

Prof. Dr. Hasan Kılıç
Dean, Faculty of Tourism

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Tourism Management.

Prof. Dr. Habib Alipour
Supervisor

Examining Committee

1. Prof. Dr. Habib Alipour

2. Asst. Prof. Dr. Cahit Ezel

3. Asst. Prof. Dr. Amir Khadem

ABSTRACT

For thousands of years, human beings have moved and travelled constantly for a range of reasons. These movements and travels are not typical of tourism today. Throughout the years, the composition, the time, the place, and the effects of travel have changed. Visiting another environment voluntarily is what is referred to as tourism. Tourism today is considered to be an important tool in identifying national and cultural identity, education, income, growth, and economic dynamism. An overview of the methods used in tourism recommendation systems, especially those that rely on user ratings for the generation of a proposal, is provided in this dissertation. To find similar users, these methods use similarity criteria between users. With more users and items in the system, the number of items that are commonly rated decreases, and group refining methods have difficulty finding users who are similar to the target user. Model-based method for categorizing users or items in the system is proposed using a new clustering method. In the proposed clustering method, users or items are classified into different clusters based on their trust relationships with other users. A comparison of the proposed method with other tested methods shows that based on the evaluation criteria used, it is more effective than the others.

Keywords: Tourism, Tourism Management, Machine Learning, Artificial Intelligence, Recommender system.

ÖZ

Binlerce yıldır, insanlar çeşitli nedenlerden dolayı sürekli hareket halinde oldu ve seyahat ettiler. Bu hareketler ve seyahatler günümüzdeki anlamıyla turizmin bir parçası değildi. Yıllar boyunca, seyahatlerin içeriği, zaman, yer ve etkileri değişti. Başka bir ortamı gönüllü olarak ziyaret etmek turizm olarak adlandırılır. Günümüzde turizm, ulusal ve kültürel kimlik, eğitim, gelir, büyüme ve ekonomik dinamizm tanımlamada önemli bir araç olarak kabul edilir.

Bu tezde, özellikle bir teklifin üretilmesi için kullanıcı derecelendirmelerine dayanan turizm öneri sistemlerinde kullanılan yöntemlere genel bir bakış sunulmaktadır. Benzer kullanıcıları bulmak için, bu yöntemler kullanıcılar arasında benzerlik ölçütleri kullanır. Sistemde daha fazla kullanıcı ve öğe varken, yaygın olarak derecelendirilen öğelerin sayısı azalır ve grup iyileştirme yöntemleri hedef kullanıcıya benzer kullanıcıları bulmakta zorlanır. Sistemdeki kullanıcıları veya öğeleri kategorilere ayırma için model tabanlı yöntem, yeni bir kümeleme yöntemi kullanılarak önerilmiştir. Önerilen kümeleme yönteminde, kullanıcılar veya öğeler diğer kullanıcılarla olan güven ilişkilerine göre farklı kümeler halinde sınıflandırılır. Önerilen yöntemin test edilen diğer yöntemlerle karşılaştırılması, kullanılan değerlendirme kriterlerine dayanarak, diğerlerinden daha etkili olduğunu göstermektedir.

Anahtar Kelimeler: Turizm, Turizm Yöneticiliği, Makine Öğrenimi, Yapay Zeka, Tavsiye sistemi.

DEDICATION

To my dear wife Fara, who always supported me. Thank you

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At the first of all, I thank my God for everything he has given me and he always helps me to go through all the stages of my life.

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Chapter 1

INTRODUCTION

"Travel" is an ancient term. Humans have been constantly moving and traveling since its inception for a variety of reasons (Siu, et al. 2013). Of course, such movements and travels are very different from what is called Tourism today. The composition, time, place and effects of travel have changed over time (Lin, et al. 2019). People are called tourists when they voluntarily leave their natural environment, or in other words, the place where they live, to see another environment (Liao, et al. 2010), (Siu, et al. 2013). These people usually engage in various activities regardless of how close or far this environment (destination) is.

Today, Tourism is considered as one of the important tools in identifying national and cultural identity, education, income, growth and economic dynamism (Baygloo, & Shaykh, 2020; Ramesh & Vishal, 2020). One of the factors for success in any business and industry is to know the customers and to communicate properly with them. The tourism industry is no exception (He, et al. 2018). Tourism is a rapidly growing phenomenon, so that today it has become an influential factor in the development of areas and provides many direct and indirect economic, cultural, social and environmental benefits to the host community (Pike, et al. 2010; Zheng, et al. 2019). At present, the tourism industry has become the third largest industry in the world after the oil and automobile industries in order to generate income and employment. Tourism is a human need. The need is rooted in the levels of material

and physical needs, the need for belonging, the need for respect, and the need for self-actualization (Ramesh, et al. 2020; He, et al. 2018). From a psychological point of view, human personality has levels of individual, group and social needs that make the need for tourism relevant at the deeper, higher and higher levels of human needs. The social and cultural effects of tourism are among the most important considerations for tourism development in any region (He & Xuehuan. 2018; Baksi & Kumar, 2014).

The countries of the world have a special place and value, and different countries of the world are trying to use this feature to attract tourists from different countries to achieve their goals, as well as generate income and create employment. Tourism has a very important position in the world economy, as it is currently the third most lucrative industry after the oil and automobile industries and an important factor for the development and progress of countries.

Today, the tourism industry by providing a high level of development for the economic sector of most countries is considered as a basic sector in economic development. In Malaysia, for example, tourism is considered as an economic catalyst and the main factors for its success are: development and planning. The development of tourism and related activities can lead to the creation of many jobs in the labor market and employment. Employment in hotels, restaurants, travel agencies, creating jobs related to the tourism industry directly and indirectly and many other activities can create income and improve the social, economic, political and psychological situation.

Today, tourism as a dynamic economic approach with distinctive and unique features has become one of the largest and most lucrative industries in the world economy. Moreover, as a platform for economic and social change in many developing countries, tourism as a booming phenomenon is constantly advancing and expanding its importance and the attention of most people around the world. This phenomenon is now one of the most important industries in the world. In many countries of the world, the tourism industry has become the most important source of income and exports, and government policies in recent decades have emphasized the development of tourism as one of the ways to combat unemployment and generate income, beyond specialized conflicts. The process and the productive attitude towards tourism, the importance of flexibility of substitution between tourism and other goods and services.

Tourism is one of the most important income-generating industries in the world today, and tourism capabilities can be used as one of the main and basic solutions to solve the problems caused by unemployment and economic recession in different countries. The tourism industry has long been of interest to human beings and today plays a special role in the global economy. In addition, this industry is an effective factor in the interaction of cultures, the dialogue of civilizations, the establishment and consolidation of friendship between nations.

Tourism as a socio-economic force is becoming one of the main pillars of the world business economy. In addition, many development planners and policy makers cite the tourism industry as a key element of sustainable development. The tourism industry is one of the most prosperous economic sectors in the world, and the countries that have been able to benefit from this industry by equipping themselves

have enjoyed the same amount of economic growth. Tourism is a broad and cross-sectoral activity that takes place in various forms at the regional, national and international levels. Artificial intelligence (AI) is based on large amounts of data, computing power, and algorithms. Each of these three elements has seen significant advancements in recent months as a result of several trends: first, the refinement and advancement of AI algorithms; second, significant improvements in processing capacities; and third, in the context of big data, the development of new and more powerful information sources and architectures that allow for the storage and processing of massive amounts of data.

For numerous reasons, artificial intelligence is particularly important to travel and tourism. Tourists must make a number of decisions on future visits, including selecting a destination, mode of transportation, lodging, and activities, among other things. These selections will have a big influence on how happy travelers are with their experience. However, the vast diversity of locations, modes of transportation, lodging, and activities now accessible creates an almost endless number of possibilities that need support. When it comes to finding the greatest match between clients and vacation packages customized to their interests, tourism organizations and brokers confront a similar issue. Organizations have access to an almost limitless pool of potential consumers. As a result, matching demand with a product is a very complicated process that appears to be well suited to AI's skills. Tourists must traverse the unknown once they get at their destination, which is defined by different customs, languages, cultural norms, and food, among other things.

While the tourist industry has been proven to be an early user of most advancement, genuine AI applications are few. The majority of the current research is focused on

laboratory and development settings. AI is presently integrated in real-world data processing systems and in the development stage of a variety of settings, such as forecasting systems, robotics, conversational systems, and voice recognition systems. In the near future, AI is anticipated to get engaged in many aspects of the travel and tourist business.

1.1 Problem Statement

Tourism Relationship Management (TRM) is very necessary for the continuation of the tourism industry (Baksi, et al. 2014), (Ballestero, et al. 2018). In fact, Tourism Relationship Management methods can attract domestic tourists and foreign tourists to the desired destinations. In the field of Tourism Relationship Management (TRM), the tourism industry needs a national planning and model in order to integrate the tourism system in the Middle East as a profitable industry and one of the most important non-oil exports (Baygloo & Shaykh. 2020), (Akgü & Ali. 2019). Tourist Relationship Management (TRM) is one of those new technologies that play a vital role in retaining customers and turning them into loyal customers. Today, due to the intensification of competition in new dimensions, more than ever before, the ability to understand and manage to establish and maintain long-term relationships with the customer to achieve business goals is considered. Fig.1 shows the characteristics of tourists (Li & Ming-Way 2020; Lin Chin-Teng & C. S. George Lee. 2019; Ballestero & Talón, 2018; Baksi, & Kumar, 2014):

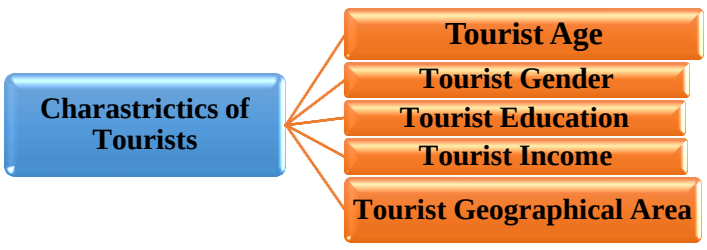

Fig 1.1: The Characteristics Of Tourists

This thesis examines effective parameters on the Tourism Relationship Management System (TRM) in the Tourism Industry and is under the title "TRMS.AI" at the first version of the thesis. As a result, it was developed with the help of artificial neural networks a pattern for assessing tourist satisfaction based on the TRMS, and further investigation is underway. There is a need for an intelligent system to be implemented in order to increase confidence and reliability simultaneously to utilize the expertise of different field specialists to solve the Satisfaction of Tourists based on TRMS.

1.2 Study Method

In this study, modeling the position of using the Tourism Relationship Management System (TRM) by adopting Artificial Intelligence methodology is to be addressed. The desired method for designing and implementation of Intelligent System in thesis data analysis is Artificial Intelligence in MATLAB programming environment. The Research methodology of this thesis is the Neuro-Fuzzy Toolkit in Matlab. The methodology of this thesis is applied-modeling because it aims to describe accurately the concepts and rules related to the thesis model. On the other hand, the relationship between these concepts and rules is assessed and evaluated by the experts.

1.3 Objectives Of The Study

The purpose of this thesis is to investigating effective parameters on the Modeling the position of using the Tourism Relationship Management System (TRM) in the Tourism Industry, and it's under the title of "TRMS.AI" at the first version of thesis. To this end, a pattern for considering the Satisfaction of Tourists based on TRMS has been developed with the help of the artificial neural network and the investigating the parameters is continued. In fact, the problems of this thesis, based on (Ballestero & Pilar Talón. 2018; Baksi & Kumar, 2014), can be the fatigue of decision-makers

of Tourism Industry due to the combination of different methods of "Tourist Age"; "Tourist Gender'; "Tourist Education'; "Tourist Income"; and "Tourist Geographical Area", in order to Satisfaction of Tourists based on TRMS. On the other hand, the need for applying an intelligent system in order to improving confidence and reliability, for simultaneously utilizing the expertise of different field specialists to solving problems of Satisfaction of Tourists based on TRMS.

Personalization and recommender systems, robots, conversational systems, smart travel agents, prediction and forecasting systems, language translation applications, and voice recognition and natural language processing systems are all examples of artificial intelligence (AI) in use today in almost every aspect of travel and tourism. Big data, algorithms, and computer power have all improved recently, allowing AI to advance significantly.

Artificial Intelligence is viewed as the next stage of the tourist business, in light of developments in ICTs. AI is recognized for its advanced computing skills, which include the ability to deal with complicated relationships and issues among many ideas, as well as the ability to work with large amounts of data. In general, an AI system detects external information, interprets it, acts in response to the information, and learns from its own experiences. AI works in the same way as a human brain in that it thinks, learns, makes decisions, and infers from data utilizing intelligent machinery. The fundamental goal of AI is to allow robots to accomplish activities without the assistance of a human brain.

Recommender Systems (RSs) have been widely used to alleviate information overload and provide visitors with trip advice. The new mobile RSs are designed

specifically for mobile device users and promise to significantly enhance visitor experiences by recommending rich multimedia material, context-aware services, peer user views/ratings, and so on. Mobile computing, wireless networking, web technologies, and social networking are all leveraging massive opportunities to provide highly accurate and effective tourist recommendations that take into account personal preferences and capture usage, personal, social, and environmental contextual parameters. The purpose of this thesis is to create a template for TRMS in the tourism sector. In addition, in the tourism business, to determine the effective indicators (e.g., age, gender, education, income, and geographic area) as well as the weight of these indicators. The ultimate goal is to create a pattern for modeling the relationships between the indicators.

1.4 Research Questions

- What are the indicators of "Tourist Age, Tourist Gender, Tourist Education, Tourist Income, Tourist Geographical Area" in the Tourism industry?
- How much is the weight of indicators of "Tourist Age, Tourist Gender, Tourist Education, Tourist Income, Tourist Geographical Area" in the Tourism industry?
- What is the relations between "Tourist Age, Tourist Gender, Tourist Education, Tourist Income, Tourist Geographical Area" in the Tourism industry?

1.5 Thesis Structure

This dissertation is compiled in five chapters. The main points of each chapter are summarized below.

In Chapter 1, motivation and importance of the research topic and research objectives are stated.

Chapter 2 first reviews the previous methods for the modeling the position of using the Tourism Communication Management System (TRM) in the tourism industry.

Chapters 3&4 describes the details and steps of the proposed method for the modeling the position of using the Tourism Communication Management System (TRM) in the tourism industry using artificial intelligence methods.

In Chapter 5, the proposed method is tested and the results are fully described. It also compares the performance of the proposed method with previous methods in the modeling the position of using the Tourism Communication Management System.

Finally, in Chapter 6, a summary and general conclusion will be provided along with suggestions for future work.

Chapter 2

LITERATURE REVIEW

2.1 Tourism: An Overview

This chapter discusses the research literature. First, it expresses the general concepts of the research literature and then it describes the previous works done.

Tourism is an activity that in today's world has the ability to affect the process of balanced and comprehensive development in Iran and different countries and is considered by many politicians, planners and executive and operational managers in countries, this phenomenon (tourism) including It is a twentieth-century phenomenon that cannot be ignored, and millions of people travel around the world each year, and the presence of tourists in countries and destinations can have advantages and disadvantages, for example, the presence of tourists in a country, in addition to Economic development and cultural exchanges are the best propaganda for security in that country.

Tourism is one of the largest and most important industries and has a rapid and undeniable growth in the current world and can be considered the most important source of income, wealth, and employment in many countries, and if a country can use these capabilities And move the wheels of this industry in his country will see a tremendous prosperity in the country's economy, the impact of this industry in various ways, including the entry of currency into the country, employment in many

areas, the dynamics of the retail market, the activation of the airport Transportation systems, increase in investment, increase in local and indigenous and industrial production (handicrafts and cultural products), increase in private sector investment (hotel construction and other related services) can be considered and important. But in order for tourism to be able to continue this rapid growth and continue to play an effective role in the field of production, income as well as productive employment and meet the diverse needs of the market, it needs to be combined with innovation and entrepreneurship. Tourism has become more and more. Tourism can pave the way for the growth and development of businesses, especially small and medium businesses in the world. He states that entrepreneurs through small and medium-sized businesses can have a great impact on the success of any industry, including tourism. Small entrepreneurial businesses have the advantage that there are few barriers to their entry into the service market.

In addition to being a spiritual, psychological and cultural issue, tourism is a profitable economic activity in accordance with different systems and the existence or creation of tourist attraction factors. From the entrepreneurial point of view, tourism is a special issue and its understanding compared to other Industrial sectors and identifying entrepreneurial opportunities and the process of turning them into a consumable tourism product are different, tourism is an important and valuable sector for investors and entrepreneurs, but the concept of tourism entrepreneurship is not yet well understood.

Travel has been with humans and humans since the beginning of creation, and throughout human life and history, the movement of humans on earth and their migration from one land to another has always played a key role in the creation and

expansion of civilizations and the first great civilizations. In Mesopotamia, the Aryans traveled to this land. A number of scholars believe that migration is necessary for a civilization.

It can be said that human beings have instinctively and naturally loved traveling and tourism and seeing other places in the world, especially unknown places, so that they can use the experiences and knowledge of other nations and countries to learn and learn while visiting other parts of the world. Let them know that this desire for travel is still present in human nature and institution, and every year millions of people around the world travel from places of interest with different motives and goals.

Tourism is a very ancient phenomenon and it can be said that human destiny is mixed with travel and familiarity with distant lands and the inhabitants of those areas, but based on historical evidence, the Sumerians can be considered the first people to make business trips and Perhaps the emergence and creation of money by the Sumerians around 4000 BC can be considered as a turning point in the socio-economic history of mankind, which led to the expansion of business and commerce, according to That trade is one of the main and first influential factors and motivations for travel should be considered the event of money creation as the source of change in travel, and since the Sumerians were also the first creators of lines and wheels, so they can be He introduced the trilogy of money, lines and wheels as the founders of the travel industry. With the fall of the Roman Empire in the fourth and fifth centuries AD, the security of leisure and sightseeing in Europe was in crisis, and from the beginning of the empire's collapse (beginning of the Middle Ages) to the Renaissance, 14th century travel in European countries was fraught with danger. The Crusades were the most important event in medieval Europe, but at the end of the

Middle Ages, many pilgrims journeyed to shrines such as Canter Bury in England and St. James in Composite, and a small number made lengthy, expensive travels. And they often went as dangerous as the Holy Land. It can be said that the collapse of the Roman Empire and the Black Age after that led to a decrease in travel and tourism in Europe, and during this period travel was associated with difficulties and hardships, but during this period Europe was moving towards recession and stagnation and society At that time it was far from progress, progress and development, Islamic lands were in their heyday and prosperity, in that era and period in Europe scientific progress was considered as infidelity and apostasy, but in Islamic countries from According to the Prophet of Islam, science was likened to a treasure that was obligatory for every man and woman to acquire and attain, and reaching knowledge through traveling to the farthest points of value and prestige was considered. One of the main reasons for the prosperity of travel in the ancient world was the trade of goods, especially silk and spices, which were transported from the east of the world to the west of the world. It was silk that was the crossing point of traders for many years, and the entry of tourists to the destination lands needed to meet the basic needs of traders and tourists, such as food, security, and the necessary infrastructure. Bristol was founded in England and the first recreational train was launched in 1841 by Thomas Cook in England. Over time, in the 19th century, travel by Delijan flourished, which resulted in the creation of intermediate coffee houses. At the beginning of the twentieth century, cars entered the transportation cycle, which led to a fundamental change in transportation, comfort and travel safety, and passenger buses also entered the transportation sector in the tourism industry following these developments. At present, the use of airplanes and ships in tourism and for the transportation of passengers has found a special place and every year

millions of people travel and tourism in different ways and with different motives. Tourism revenue, along with passenger transportation, accounts for about 17 percent of world exports.

The Table 2.1 compares the most important findings and results of the present study with the most relevant Researches in theoretical literature:

Table 2.1: Comperison of the Findings of the Most Relevant Researches in Theoretical Literature

Authors	**Research Findings**															
	Tourist	CRM	TRM	Satisfaction	Tourist Age	Tourist Gender	Tourist Education	Tourist Income	Tourist Geographical Area	Satisfaction of Tourists based on TRMS	Matlab programming	Artificial Neural Networks	Expert System	Fuzzy Logic	Statistical Analysis	Research Validation	Case Study: Tourism Industry
(Li, et al. 2020)	*	-	-	*	-	*	*	-	-	-	-	-	-	-	-	*	-
(Lin, et al. 2019)	*	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-
(Ballestero, et al. 2018)	*	*	-	*	*	-	-	-	-	-	-	-	-	-	*	-	-
(Baksi, et al. 2014)	*	-	*	-	*	*	-	*	-	*	-	-	-	-	-	*	-
(Siu, et al. 2013)	*	*	-	*	*	-	-	-	-	-	-	-	-	-	*	*	-
(Liao, et al. 2010)	*	*	-	-	-	-	-	*	*	-	-	-	-	*	-	-	-
This Thesis	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

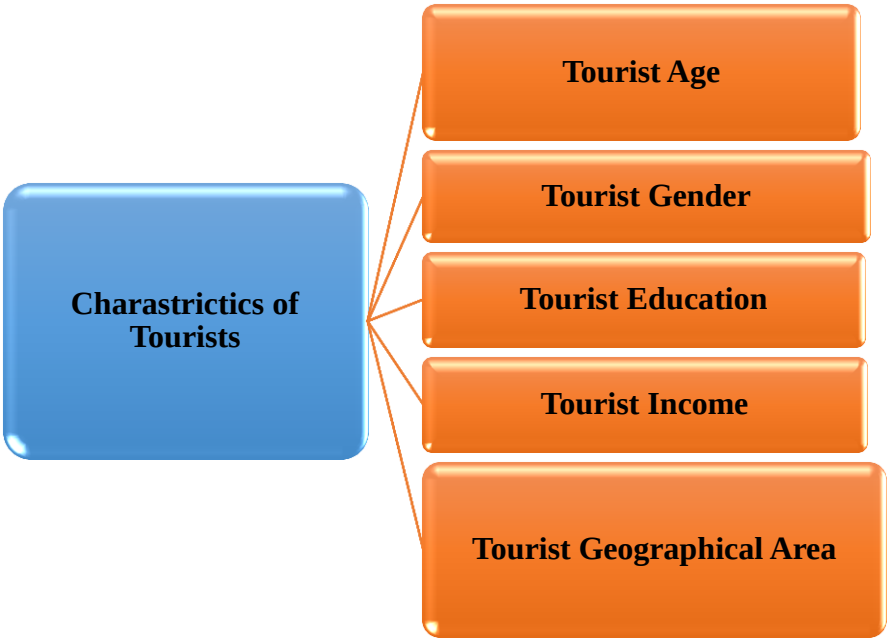

Fig 1.2: The Characteristics of Tourists

Today, Tourism is considered as one of the most important and dynamic industries in the world. In many countries, this industry is considered as the main source of income, employment, private sector growth and infrastructure development (Li & Ming-Way; 2020). On the other hand, Tourism Relationship Management is not a concept or a project, but a business strategy that aims to understand, anticipate and manage the needs of current and potential business customers. It is also a series of strategic, process, business and technology-based changes that allow businesses to better manage their customers, (Ballestero & Talón, 2018). One of the most important needs of businesses and agencies today is to use tourism relationship management in relational marketing in dealing with tourism. One of the best quality improvement tools in today's world is the optimal use of information technology based on customer orientation approaches (Ballestero & Talón, 2018), (Zheng & Weimin, 2019).

Table 2.2 shows the Tourism Statistics 2019 based on Most Recent Value:

Table 2.2: Tourism Statistics2019 Based On Most Recent Value (Thousands) (World Bank, 2019), (OECD, 2019), (UNWTO, 2020)

Top 20 Countries	Middle Countries	20 Weakest Countries
France	Belgium	Liechtenstein
89,322.00	9,119.00	85.3
Spain	Kazakhstan	San Marino
82,773.00	8,789.00	84
United States	Kuwait	St. Vincent and the Grenadines
79,745.92	8,508.00	80
China	Tunisia	Timor-Leste
62,900.00	8,299.00	75
Italy	Sweden	Djibouti
61,567.20	7,440.00	63
Turkey	**Iran, Islamic Rep.**	Dominica
45,768.00	**7,295.00**	63
Mexico	Philippines	Sierra Leone
41,313.00	7,168.00	57
Germany	Argentina	Tonga
38,881.00	6,942.00	54
Thailand	Brazil	Guinea-Bissau
38,178.00	6,621.00	45.2
United Kingdom	Dominican Republic	Comoros
36,316.00	6,569.00	35.9
Japan	Cambodia	Sao Tome and Principe
31,192.00	6,201.00	33.4
Austria	Chile	Mauritania
30,816.00	5,723.00	30
Greece	Norway	Solomon Islands
30,123.00	5,688.00	27.9
Hong Kong, China	Uzbekistan	American Samoa
29,263.00	5,346.00	20.2
Malaysia	Albania	Micronesia, Fed. Sts.
25,832.00	5,340.00	19.2
Russian Federation	Nigeria	Mali
24,551.00	5,265.00	14
United Arab Emirates	Syrian Arab Republic	Turkmenistan
21,286.00	5,070.00	8.2
Canada	Georgia	Kiribati
21,134.00	4,757.00	7.1
Poland	Cuba	Marshall Islands
19,622.00	4,684.00	6.8
Netherlands	Slovenia	Tuvalu
18,780.00	4,425.00	2.7

Since the late 1990s, artificial intelligence (AI) studies have been used in tourism research to anticipate hotel occupancy and tourism demand. Following that,

researchers used AI to a variety of investigations, including resource management in tourism businesses examining social media data and online reviews, forecasting tourist flow and arrivals, evaluating tourist satisfaction through facial expression recognition, and making smart recommendations. AI models are increasingly being utilized in tourist research because they are considerably more flexible and can be used to estimate non-linear connections without the limitations of previous approaches.

Despite the fact that AI, with its sophisticated processing and problem-solving skills, promises totally different solutions for potential and prospective tourist challenges, there is a dearth of academic study on AI in the context of tourism.

Understanding the current situation in the process of economic development has a decisive effect in recognizing the correct planning path for tourism development (Ramesh, et al. 2020). In addition, in today's world, business retrieval destinations and Researchers, due to the influence and potential of websites and social networks as a tool to provide information and image of the destination and subsequently influence the behavior of tourists and destination selection, increasingly attract this attention (Ramesh Vani & Vishal C. Jaunky , 2020).

Finally, the problems of this thesis can be the fatigue of decision-makers of Tourism Industry due to the combination of different methods of implementing TRM. On the other hand, the need for using an intelligent system is in order to increasing confidence and reliability in decision making, as well as the need for multiple expertise by simultaneously utilizing the expertise of different field specialists to solving problems of Tourism Relationship Management System.

In fact, the aim of the thesis is to identify the variables affecting the implement of TRM in the tourism industry based on Tourist Age, Tourist Gender, Tourist Education, Tourist Income, Tourist Geographical Area, and then model the relationship between those variables and finally implement those variables using artificial intelligence systems.

In this thesis, modeling the position of using the Tourism Relationship Management System (TRM) in the Tourism Industry using Artificial Intelligence methodology is to be addressed. The desired method for designing and implementation of Intelligent System in thesis data analysis is Artificial Intelligence in MATLAB programming environment.

The Research methodology of this thesis is the Neuro-Fuzzy Toolkit in Matlab. The methodology of this thesis is applied-modeling because it aims to accurately describe the concepts and rules related to the thesis model. On the other hand, the relationship between these concepts and rules is assessed and evaluated by the experts.

In this Thesis, the Tourism Statistics based on (World Bank, 2019), (OECD, 2019), (UNWTO, 2020), will be used.

One of the most important reasons for using artificial neural networks and fuzzy systems in this thesis is that real world issues typically have a complex structure, which implies ambiguity and uncertainty in their definition and understanding (Tijskens & Astrid, 2019). Ever since it has been able to think, it has always been ambiguous in various social, technical and economic issues. The human brain defines and evaluates sentences by considering various factors based on inferential

thinking, whose pattern in mathematical language and formulas, if not impossible, will be very complicated (Mossalam & Arafa. 2018). Linguistics variables are expressed on the basis of language (spoken) values that are in the phrase set (words / terms), and language expressions are attributes for linguistic variables. Here, linguistic variables are said to be variables that words, and sentences of human and machine languages are acceptable values for them instead of numbers.

Chapter 3

TOURISM AND TECHNOLOGY: INNOVATIVE APPROACH

The first scholarly multidisciplinary journal concentrating on the nature and role of information technology in the context of tourism, travel, and hospitality is Information Technology & Tourism (ITT). Information and communication systems integrated in a worldwide net have had a profound impact on these businesses, as have these companies' position in the electronic market, which has an impact on IT development. This journal will present and debate advances in the usage and creation of tools, technologies, and techniques that have allowed the efficient integration of information and communication systems in tourism, travel, and hospitality.

The primary goal of Information Technology & Tourism is to contribute to the process of theory development, and therefore to the growth of research and study in this expanding subject. As an interdisciplinary publication, it encourages both industry-oriented and academic theory-focused research. ITT will include both empirical case studies and technical-theoretical articles examining tourism-travel-hospitality from an IT standpoint as well as IT from an applied standpoint. The journal publishes research papers, cutting-edge reviews, research notes, and business practice evaluations. It is also intended to incorporate articles pertinent to the business in various national settings.

Apparently, tourism technology has a significant influence on the industry's movement. It swiftly alters the market behavior of both providers and buyers.

Indeed, upheaval in hotel software development services was triggered by information technology. Tourism technological innovation appears to have brought additional value to the value chain. Clearly, travel itinerary planning is now including numerous technical advances, such as online booking engines, real-time transaction management, or an all-in-one travel marketplace platform.

As a result, new tourist technology promotes fair consumer interactions by discouraging the use of potentially asymmetric information. Users may now easily explore reliable information on the internet from a variety of sources. They would not be swayed by biased information from the media or vendors.

Clearly, technology is deeply ingrained in the tourist business, influencing every action in the market. In which the travel and hospitality industries face both opportunities and problems in reaching their consumers.

3.1 Tourism Technology Disruption

Among the numerous businesses, online travel agencies (OTAs) have shown to have a significant impact on consumer experience on the internet. Over 75% of travellers booked their trip arrangements on the internet, according to Google Trip. Traditional companies like as Agoda, Booking.com, and Airbnb have enjoyed considerable gains from the leisure travel market as a result.

Traveloka, an all-in-one travel booking platform for flights, accommodations, hotels, and even vehicles, is an example of a successful Asian player. According to

Traveloka, it now offers 40 million regular customers with a range of payment options.

From the perspective of users, tourism technology has a considerable impact on the decision-making of millennials, who are tech-savvy and passionate "traveloholics." In addition, this generation has the financial wherewithal to pursue their interests. As a result, tourists and hotel guests have learned to expect social networking, mobile technologies, and reviews.

3.2 Technology's Impact on the Tourism Industry

When it comes to the influence of technology on the travel and tourism sector, it is impossible to overlook the digital revolution in post-pandemic, which is forming a new world order across multiple continents.

When COVID19 shuts down the bulk of international flights in Europe and Australia, travel software development businesses are forced to focus on domestic tourism. Clearly, many hotels and OTAs are presently promoting their bargain packages aimed at domestic passengers rather than premium services for foreigners.

On this case, the effect of technology in tourism is illustrated through real-time booking engines with a variety of alternatives and promos. AI and Machine Learning are being used in pricing comparison in various travel booking sites to give consumers with the best possible bargains. Furthermore, AI and chatbots provide a tremendous potential to improve customer experience by providing immediate, no-wait help. Despite significant technological limitations, on-demand AI helpers would revolutionize the tourism industry's human resource operations.

Travel activities appear to have altered as a result of the impact of social media platforms, such as Instagram, Facebook, and Snapchat, which have resulted in people taking more photographs on their journeys. As a result, the desire to share travel experiences appears to be a basic inclination among travelers. Here are some data that can alert you to how much social media influence individuals have during or after a trip:

• More than 70% of social media accounts post photographs from their travels.

• Approximately 35% of tourist decisions were influenced by information accessible on social media about destination and lodging.

• Surprisingly, people appear to spend more time on social media throughout their trip.

According to market analysts in Australia, visualized content (using AR and VR technologies) would likely dominate social sharing. Furthermore, mobile-enabled technologies would change the way businesses engaged internet travelers.

Unfortunately, the notion of sharing gradually destroys the boundary of privacy and personal identity since private data may be used to perpetrate heinous actions.

Users might generate false news, fake reviews, or phony experiences from social media properties, without a doubt, to hurt competitors as a nasty PR tactic. As a result, the rise of social media and the trend of an online presence will push the application of technology in the tourist sector. Companies would also need to prepare for online communication disasters.

It has become increasingly difficult for customers to find and choose information due to the exponential growth of online environments, as well as a lack of knowledge and time. Information overload has made recommender systems a helpful tool for internet users. RSs compare available information items to reference characteristics and provide item recommendations based on information from registered user profiles and the behaviors of the whole user community (Adomavicius and Tuzhilin, 2005, Ricci et al., 2011). A RS frequently compares a user profile to certain reference attributes in order to anticipate the 'rating' or 'preference' that a user would award to an item she has not yet evaluated.

RSs were originally used on e-commerce websites to provide information on items and goods that the user would be interesting in (for example, films, books, news, web pages, and so on). They've lately been popular in the sector of electronic tourism (e-tourism), where they provide services like travel and activity advice, POI listings that match user interests, tourist package recommendations, and so on (Kabassi, 2010, Werthner and Ricci, 2004). Existing RSs in e-tourism often resemble tourist agency services, in which potential tourists seek advice on holiday destinations under specific time and budgetary constraints (Berka and Plönig, Ricci, 2002). The user typically sets her requirements, interests, and limits based on the criteria selected. The system then connects user selections with cataloged locations that have been tagged with the same vector of parameters.

The use of mobile devices as a major platform for information access is a relatively new trend in e-tourism, resulting in the development of the sector of mobile tourism. Mobile tourism's particular qualities provide new challenges and opportunities for the creation of fresh customized services that do not exist in the field of e-tourism.

For example, knowing the precise user position creates acceptable basis in order to provide location-based services Furthermore, user mobility allows for the use of information from a user's mobility history as well as the usage of a user's nearby social context.

In the next section the details of the novel proposed recommender system-based in tourism industry are described.

Chapter 4

METHODOLOGY

4.1 Introduction

Following the great progress in tourism and anticipating it becoming the world's largest export industry, most countries in the world have made industry development a priority in their tourism program. Government planners and commercial enterprises have studied the growth of tourism in all regions, whether national, regional, or worldwide. Many countries are rapidly recognizing that they must take the initiative to better their economic position.

Tourism has sometimes become a very broad notion in different economic, social, and cultural aspects, as well as an industry, due to the fact that it provides a highly suitable and important source of foreign currency income to the country's economy. Please think about it. This dynamic business is seen as the major source of revenue, employment, private sector growth, and infrastructure development in a large number of nations. As a result, while the situation varies by location, tourism is always an essential component in economic growth. In terms of tourist attractions, Iran is ranked tenth in the world, and fifth in terms of biodiversity. but it does not have an appropriate position in terms of tourist attractiveness, since tourism income accounts for just approximately one thousandth of the worldwide income from this business. Tourism is particularly essential for developing nations, which confront

issues like high unemployment, low foreign exchange resources, and a single-product economy.

The tourist industry's expansion is critical in order to diversify the country's sources of economic growth and foreign exchange revenues, as well as to generate new job possibilities. Iran's economy is largely reliant on oil export revenues, and its macroeconomic factors change dramatically over time in response to world oil prices. As a result, growing the tourist industry is critical for diversifying growth sources from economic and foreign exchange profits as well as creating new job possibilities in the country. Following the definition of the research's main terms, we discuss the artificial neural network approach and its findings in this study. One of the artificial intelligence approaches used to forecast and cluster is the neural network.

4.2 Details of Proposed Method

By paying attention and paying attention to the influential areas in tourism recommendations, especially in mobile applications, recommendations can be produced according to user conditions and maximum user satisfaction can be achieved. Effective conditions in a recommendation may include his or her environment, current time, constraints, choices of people with similar tastes, how to obtain a proposal, and so on [1]. The use of context, as dynamic information that describes the status of users and items and influences the decision-making and selection process of users, by tourism recommendation systems, is essential to improve the quality of bidding. One of the most important issues in tourism recommendation systems is providing high performance and quality offers to users in the system. Providing good and constructive suggestions to users in a tourism

advisory system is possible if this system can predict the rankings of users in different places or in other words, the degree of interest of users in different tourist places with high accuracy. Therefore, high-precision predicted rankings provide better offers to users in tourism recommendation systems. In fact, in this dissertation, an attempt is made to provide users with a new recommending system by combining background information with the criterion of trust and clustering to increase the accuracy of suggestions. In [2] a criterion is presented to show the reliability of a forecast in tourism recommendation systems. Also, using different evaluations, it has been shown that this criterion has a high correlation with the accuracy of the predicted rankings. In this reliability criterion, only the similarity between users is used. Therefore, one of the problems of this criterion is its low capability and efficiency in dealing with the thinness of the user-place tourism matrix. For this purpose, in this chapter, by combining this criterion with background information and user clustering, a new recommender system is presented. This proposed reconstruction mechanism is implemented on trusted networks that have low reliability, and users with lower reliability than a threshold are removed from the target user's trust network. Therefore, the use of this mechanism creates higher quality trust networks based on the proposed reliability criteria. In addition, the use of contextual information along with the criterion of trust increases the accuracy of ranking predictions and thus provides more favorable recommendations to users. Given that in the proposed mechanism for rebuilding the trust network, users with low reliability are eliminated, therefore, it should be borne in mind that the proposed method should not significantly reduce the rate of ranking coverage.

One of the most important problems and challenges in tourism recommendation systems is choosing a neighbor for the target user in order to predict the user's

rankings. Group refinement tourism advisory systems that predict rankings based on the target user's neighboring users should be able to identify the target user's neighbor users well. In such systems, by choosing the right neighborhood of users, high accuracy ratings can be predicted for the target user. The selection and designation of neighboring users in tourism recommendation systems faces challenges. One of the problems in this area is the problem of thin data and cold start users. If a target user is ranked in a small number of tourist destinations, it will be difficult to calculate the similarity between this user and other users in the system. As a result, choosing the right neighborhood for this user will not be an easy task.

One of the methods that have been used to solve the problem of neighborhood selection in tourism recommendation systems is the clustering method [3-11]. Clustering allows users or similar tourist locations to be in the same cluster. Therefore, users in the target user cluster can be used to predict the desired ranking. Although the clustering method can be a solution to the problem of neighborhood selection in tourism recommendation systems, but this method also faces limitations and problems. Determining the correct number of clusters is a major issue in clustering-based methods. Because the efficiency of these methods depends on the initial definition of the number of clusters, and if the appropriate number of clusters is not determined, these methods cannot have good performance. Another problem is the inadequacy of the clusters produced.

Poor clustering results may reduce forecast accuracy as well as rank coverage rates. This problem mostly occurs when during the clustering process, clusters are obtained that the number of members of these clusters is very small and therefore these clusters cannot provide suitable neighborhoods for users in these clusters. On the

other hand, many clustering-based tourism recommendation systems use only the criterion of similarity between users or tourist locations to cluster them. This makes the clustering method unable to perform clustering well for cold start users as well as in high-thin data. Therefore, the use of factors other than similarity criteria, such as trust relationships and background information, can help these methods to better categorize users or tourist locations in the system.

According to the above-mentioned issues, group purification systems had weaknesses that some of these problems can be solved by using background and social information as additional information in these systems. In this sense, explicit or implicit trust derived from (profiles) of users can be utilized as social information (additional or auxiliary) in group refining systems to improve their accuracy and coverage. As a result, we can correctly anticipate the intended ranks for the current user based on the trust network formed by users. This chapter's objective is to create tourism advising systems based on background data. These systems reduce as much as possible the shortcomings of traditional tourism recommendation systems and thus make predictions more accurately, while maintaining coverage for users and rankings. In fact, the method presented in this chapter is a memory-based method based on tourism information systems based on background information, which is used as social and additional information in traditional tourism recommendation systems. Accordingly, in order to achieve a sensible tourism advisory system, a proposed solution has been proposed to predict the rankings.

In the proposed method, social information, context and methods based on fuzzy clustering have been used to provide appropriate recommendations. Using the proposed method, the accuracy of knowledge-based tourism advisory systems can be

increased. In fact, in this proposed method, by adding user clustering, the similarity and reliability of users and tourism locations to context-based tourism recommendation systems and providing a better system, as will be shown below, improve the coverage and accuracy of such systems In other words, in the proposed method, in addition to increasing the accuracy of forecasts, the amount of coverage is also increased and recommendations can be presented to users in the tourism advisor system with more confidence.

In this section, a new clustering method is introduced to increase the efficiency of tourism information systems based on contextual information. The major goal of this suggested technique is to leverage the dependability criterion and background information to improve the accuracy of ranking predictions in tourist recommendation systems. To that aim, a new dependability metric based on contextual information has been created, and it has been utilized to provide a method for rebuilding the network of users' confidence in trust-based tourist advising systems. The structure of the proposed method is shown in Figure (4-1) which has six steps including: (1) building a trust network, (2) predicting the initial ranking, (3) calculating the reliability criterion, (4) rebuilding the trust network, (5) Final ranking prediction, and (6) Top-N suggestion is the destination of interest to the target user. In the following, each of the steps of the proposed method is described in detail. As illustrated in Figure 4.1, the proposed method based on reliability criteria consists of two general phases. First, in the first phase, an initial prediction of the ranking of the desired tourist destination for the target user is made based on the initial trust network. Then, based on this initial rating, the proposed criterion for reliability is calculated. If the calculated criterion for the reliability of the desired rating is lower than a certain threshold, the proposed method for rebuilding the target user's trust

network will be implemented and a new trust network will be obtained for this user. Then, in the second phase, based on the newly obtained trust network, the final ranking for the desired tourist place is obtained. Finally, based on the predicted ratings for the target user, N higher ranked tourist destinations are suggested as the target user's favorite tourist destinations.

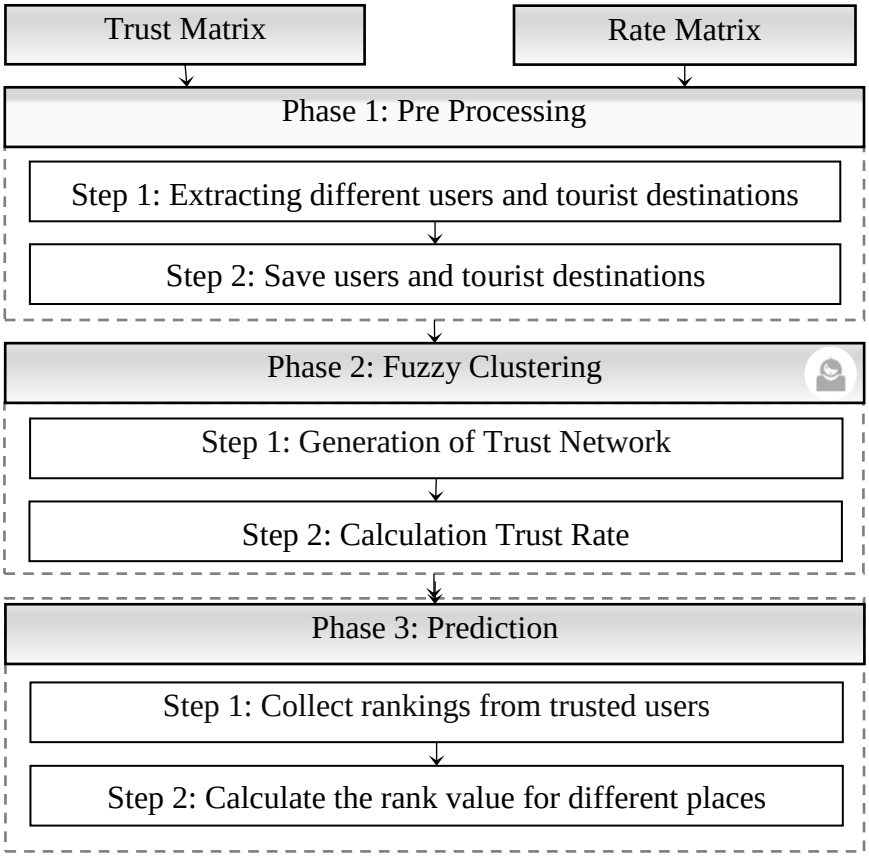

Figure 4.1: Flowchart of the Proposed Method

As it stated, in this method, fuzzy clustering is used for clustering. In Clustering, one of the most widely used algorithms is fuzzy clustering algorithms. For each of the clusters, the data points are assigned membership values and fuzzy clustering algorithm allow the clusters to grow into their natural shapes. The fuzzy clustering

algorithms can be divided into two types one is Classical fuzzy clustering algorithms and other is Shape based fuzzy clustering algorithms.

Fuzzy clustering is a strong unsupervised approach for data analysis and model development. Fuzzy clustering is more natural in many circumstances than hard grouping. Objects on the borders of many classes are not required to fully belong to one of the classes, but are instead awarded membership degrees ranging from 0 to 1, indicating their partial membership. The fuzzy c-means algorithm is the most commonly utilized.

Moreover, for the prediction phase neural network is used. Pattern recognition and classification is one of the most important applications of statistical methods in various sciences. One of the main goals of modeling and classification in statistics is to predict based on existing facts and variables and available information on a specific topic. In statistics, this task is mainly based on methods such as regression, audit analysis, time series, classification, tree regression.

Statistical classical methods for modeling relationships between variables have a number of assumptions and limitations. Consideration of a default distribution such as normal distribution for response variables, linearity of the proposed relationship, uniformity of variance of errors, etc. are among the limitations of classical methods that when using these methods, if real data, conditions Assuming they do not have the model, the use of these methods is not possible or is accompanied by a significant error. In addition, none of these methods have the ability to model complex nonlinear relationships and high-degree interactions. The greater sensitivity of these models to missing observations and discarded data is another limitation of these methods.

Therefore, there is a need for methods that face fewer limitations in this area. Meanwhile, neural network models can be one of the most suitable methods. Artificial neural networks, or more simply neural networks, are new computational systems and methods for machine learning, demonstration of knowledge, and applied knowledge to overstate the output responses of complex systems. The main idea of such networks is inspired by the way the nervous system works, to process data, and information in order to learn and create knowledge. The key element of this idea is to create new structures for the information processing system.

In this paper, a multi-layered neural network will be used to predict and calculate the cost of electricity in a distribution network. Multilayer neural networks are one of the most widely used types of neural networks that have a great ability to solve many problems. One of the most important and widely used of these networks is the Multilayer perceptron neural network, which uses a post-release training algorithm to train the network. In the following, we will briefly introduce the structure and training algorithm of this network. The general structure of a post-diffusion multilayer network is shown in Figure 4.2.

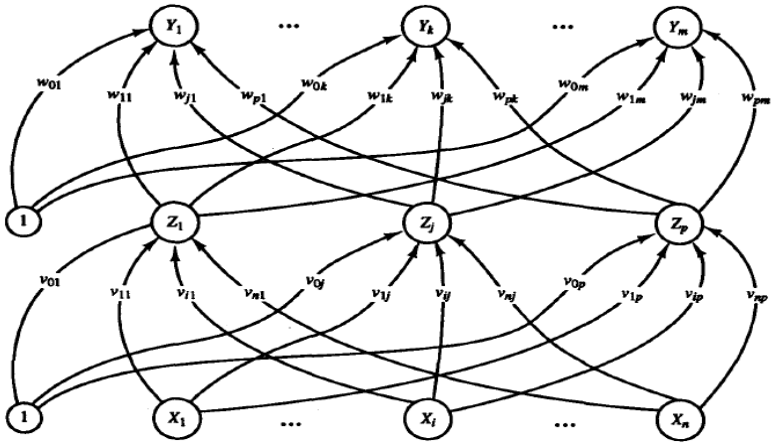

Figure 4.2: The Structure of A Multi-layer Neural Network With A Hidden Layer

The neural network shown in Figure 4.2 shows an input layer (X neurons), a hidden layer containing hidden units (Z neurons), and an output layer (Y neurons). As can be seen in this figure, the output units and the hidden units can also have bias. The number of neurons in our input layer in this dissertation will be equal to the number of input data in our problem. For example, if the number of input data in our problem is 5 attributes, the first layer of the neural network will also have 5 neurons. Also in the middle layer we have hidden neurons. In most cases, the prediction of 10 to 20 neurons will be appropriate. In this dissertation, the initial performance of the network was examined in a number of initial repetitions, and in the end, based on the initial answers, it was concluded that 10 neurons in the hidden layer will have the best performance. Also, in the output layer, we will have the number of outputs of the neuron problem. Due to the structure of our problem and its output, the hidden layer will have a neuron.

Learning a perceptron neural network involves three steps: feed forward training pattern, then back forward related error, and adjusting the weights. In the forward step, each X_i input unit receives an input signal and sends this signal to each of the $Z_1,\ldots, Z_p$ units. Each hidden unit then calculates its activation and sends its signal, Z_i, to all output units. Each Y_k output unit calculates its activation (equal to y_k) to form the network response for the input pattern provided.

Chapter 5

EVALUATION OF PROPOSED METHODS

5.1 Introduction

In this chapter, we will evaluate the proposed methods presented in the previous chapter. Therefore, first, after describing the datasets used and the evaluation criteria used to measure the error and coverage of users and items, we compare the proposed methods with each other and other existing new methods. In addition, in the second proposed method, we evaluate the sensitivity of the parameters used and evaluate the desired parameters with different values in order to achieve the optimal threshold values. We will also examine the performance and computational complexity of each of the proposed methods compared to the other methods.

5.2 Datasets

Because the proposed methods for the tourism management system are based on trust-based tourist recommendation systems. In order to evaluate these methods, we have used data sets in which each user has expressed his / her trust in other users. In such a data set, in addition to the user-item matrix, a trust matrix is also used to show the trust relationships between users. These include the TripAdvisor and Netflix datasets. Typically, in these datasets, the thin user-item matrix is more than 99%, and in order to calculate the thinness of the user-item matrix in each dataset, the ratio of 4.1 is used [1].

$$Sparsity = \left(1 - \frac{\#Ratings}{\#Users \times \#Items}\right) \times 100\%$$

5.2.1 TripAdvisor Database

TripAdvisor Database is a database of hotel information and rankings of users who oppose these hotels. In this data set, each hotel is considered as an item that each user gives a score between 0 and 5 to the various criteria of the hotel, including location, cleanliness, rooms, service, etc. In fact, it can be said that the matrix of streams has three dimensions of users, hotel, and criteria that each user assigns a rank to each hotel criterion. The following figure shows a part of the database. As can be seen in this figure, each has rated the different features of the hotel.

User ID	Overall rating	Value aspect	Rooms aspect	Location aspect	Cleanliness aspect	Hotel ID
11	5	-1	5	5	5	hotel_572859
14	5	5	5	5	5	hotel_566077
18	5	5	4	-1	5	hotel_565550
20	3	3	4	2	5	hotel_566077
22	4	3	3	3	4	hotel_570888
45	5	5	5	5	5	hotel_570888

5.3 Evaluation Criteria

Different criteria can be presented to evaluate intelligent tourism systems, in all of which the most important criteria in the recommendation systems are error rate and coverage. One of the problems in recommending systems is to create a fit between these two criteria, because the existing criteria do the opposite and by increasing the improvement in one, we will reduce the improvement in the other criterion. In the following, we introduce some relations in order to calculate the mentioned criteria.

5.3.1 Error Measurement Criteria

In the error criterion, the difference between the predicted values and their actual value is calculated. It is clear that the smaller the target errors for a recommender system, the closer the predicted rates are to the user's actual rates, and the more efficient the system will be. Among these criteria, we can mention the criterion of average absolute error and average absolute error of the user to measure the accuracy of ranking predictions, which we will show the relationships related to each [2].

$$MAE = \frac{\sum_u \sum_i |r_{u,i} - p_{u,i}|}{N}$$

In the above relation, MAE is the mean of absolute error, N indicates the number of ranks in the user-item matrix, $r_{u,i}$The actual rank of the user u to item i and $p_{u,i}$ The value of the rank predicted for item i by the recommender system.

$$MAUE = \frac{\sum_{u \epsilon U} MAE_u}{N}$$

Also in this regard, MAUE is the average absolute error of the user; N represents the number of users and $MAE_u$is the average absolute error for user u, which is calculated separately by the above relation for each user u.

5.3.2 Coverage Assessment Criteria

In the coverage criterion, the coverage of users and items is examined according to the ranking done. The result of these criteria is a value between 0 and 1, and the closer the value is to 1, the better coverage for each of the criteria for covering users and items. In fact, the criterion for user coverage is to examine how many of these users who have been recommended have at least one rating prediction in their items. The item coverage criterion also shows how many items are anticipated among the total recommended items. In the following, we present the relationships of these criteria.

$$UC = \frac{N_i}{N_t}$$

Here, the UC value of user coverage N_i represents the total number of active users for whom the recommendation system was able to predict at least one rank, and N_t represents the total number of active users.

$$RC = \frac{N_r}{N_c}$$

In the above relation, RC is the value of item coverage, N_r represents the total number of items for which the recommending system was able to predict a value as a rank, and N_c is the total number of items for which we intended to predict the rank.

5.4 Evaluation Of The Proposed Method

In this section, we intend to review the results obtained for the proposed method in order to evaluate the proposed method with other new methods. The data set was used to evaluate the proposed method. In this data set, by extracting different users and items, we can have different evaluations of the results. Finally, in order to measure the error rate and coverage of the proposed method compared to other

methods, the criteria of MAE, MAUE, RC and UC have been used, the relationships of each of which are shown in Section 3-4.

As mentioned, for further evaluation, different users and items have been extracted from TripAdvisor datasets, which are:

• Users who have sorted less than 5 items are known as “cold users”.

• Users who have sorted more than 10 things are known as “heavy raters”.

• “Opinionated users” are those who have rated more than 4 things and have a standard deviation of more than 1.5.

• “Black sheep users”: Users who have rated more than 4 products and have a rating differential of more than one between their ratings and the average rating provided to that item.

• Items having a standard deviation of greater than 1.5 are “Controversial User”.

• “Niche objects” are those that have only been categorized once or twice.

5.5 Evaluation Of Results

In the following, we will evaluate the results for different user groups and items in the TripAdvisor and Netflix datasets compared to other methods. The results of the algorithm implementation for different groups of users and items are given in Tables 5.1 and 5.2 for different criteria.

Table 5.1: Results of the Suggested Technique Assessment on the Trip Advisor Datasetfor the MAE and RC Evaluation Criteria

Views	MAE				RC			
	CF	MT	Base	Proposed method	CF	MT	Base	Proposed method
All data	0.892	0.797	0.714	**0.673**	50.84%	72.14%	88.13%	**72.12 %**
Cold users	1.102	0.754	0.765	**0.639**	3.28%	41.17%	91.82%	**41.16 %**
Heavy raters	0.851	0.796	0.794	**0.699**	57.43%	75.93%	87.49%	**75.93 %**
Opin. Users	1.223	1.176	1.203	**0.940**	49.74%	71.16%	92.73%	**71.14 %**
Black sheep	1.353	1.202	1.211	**0.959**	52.67%	70.94%	96.95%	**70.92 %**
Contr. Items	1.534	1.602	1.626	**0.981**	44.61%	81.52%	99.81%	**81.50 %**
Niche items	0.812	0.810	0.853	**0.671**	13.06%	20.75%	55.33%	**20.75 %**

Table 5.2: The TripAdvisor Dataset Was Used To Test The Suggested Approach For The MAUE And UC Assessment Criteria.

Views	MAUE				UC			
	CF	MT	Base	Proposed method	CF	MT	Base	Proposed method
All data	0.964	0.794	0.786	**0.706**	40.36%	63.28%	**97.86%**	63.25 %
Cold users	1.178	0.721	0.762	**0.647**	2.94%	43.42%	**94.94%**	43.40 %
Heavy raters	0.907	0.817	0.795	**0.714**	86.02%	84.29%	**100%**	84.29 %
Opin. Users	1.361	1.202	1.187	**0.986**	61.25%	74.07%	**100%**	74.05 %
Black sheep	1.385	1.237	1.243	**0.996**	65.21%	71.30%	**100%**	71.29 %
Contr. Items	1.527	1.554	1.563	**1.012**	14.89%	30.28%	**37.12%**	30.27 %
Niche items	0.843	0.823	0.858	**0.674**	11.24%	34.61%	**51.98%**	34.61 %

As we can see, the proposed method has been compared with three other methods called CF, MT and the basic article in order to evaluate the results. The Pearson similarity criteria are used to calculate the similarity of the active user to other users in the CF method. In order to forecast the ratings for the active user, the computed similarity is used as the effect weight of each user. In addition, only trusted users of the active user are consulted in the MT method, and the weight of trust between users is computed depending on their distance from the active user. Finally, the basic method, in order to predict the desired rankings for the active user, based on a similarity relationship, identifies the closest and most trusted users to the target user and predicts the target user's rank based on their rank.

According to the results obtained for different methods and criteria, as shown in Tables 5.1 and 5.2. The CF method, compared to other methods, has a low amount of coverage for users and items in cold start users, which is due to the use of similarity criteria in the method. Due to this sort of user's minimal resemblance to other current users, the quantity of similarity is generally zero, resulting in unexpected rankings for products and individuals. As a result, cold start users' coverage would dwindle, whereas other techniques have handled the problem by utilizing the trust criterion and distributing the confidence they have in the trust network. Furthermore, when compared to previous techniques, the suggested method has lower MAE and MAUE. This shows that the suggested technique makes less mistakes when predicting ranks and can predict rankings more correctly than previous methods.

Furthermore, the suggested technique preserves the RC and UC values, which reflect the coverage of people and objects, respectively, in trust-based adviser systems, in addition to enhancing accuracy. Also, the Base method has more coverage for users and items than the other methods, but because all users are considered trusted users, this method will have a problem with attacking malicious people, whereas the proposed method, like the MT method, uses only trusted users to predict the rank, which solves the problem mentioned in this method. Also, the proposed method, in addition to maintaining the amount of coverage of the MT method, has improved the accuracy of predicting rankings compared to this method.

Finally, in order to visually display the results, the error rate and coverage of items and users on the TripAdvisor data set are shown cold for all users and users. As a consequence, the results acquired for the MAE and MAUE criteria are displayed in Figure 5-1, and the results obtained for the RC and UC criteria are presented in

Figure 5-2, for all users in this data set. Figure 5-3 shows the findings for the MAE and MAUE criteria for cold start users, whereas Figure 5-4 shows the results for the RC and UC criteria.

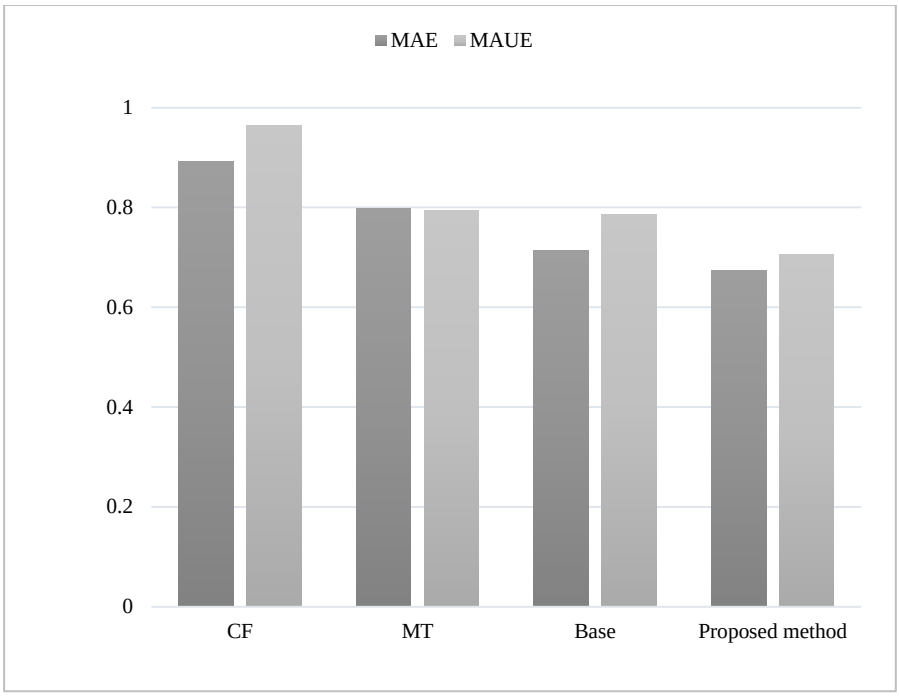

Figure 5.1: For All Users On The TripAdvisor Dataset, The Suggested Approach Was Evaluated Using The MAE And MAUE Assessment Criteria

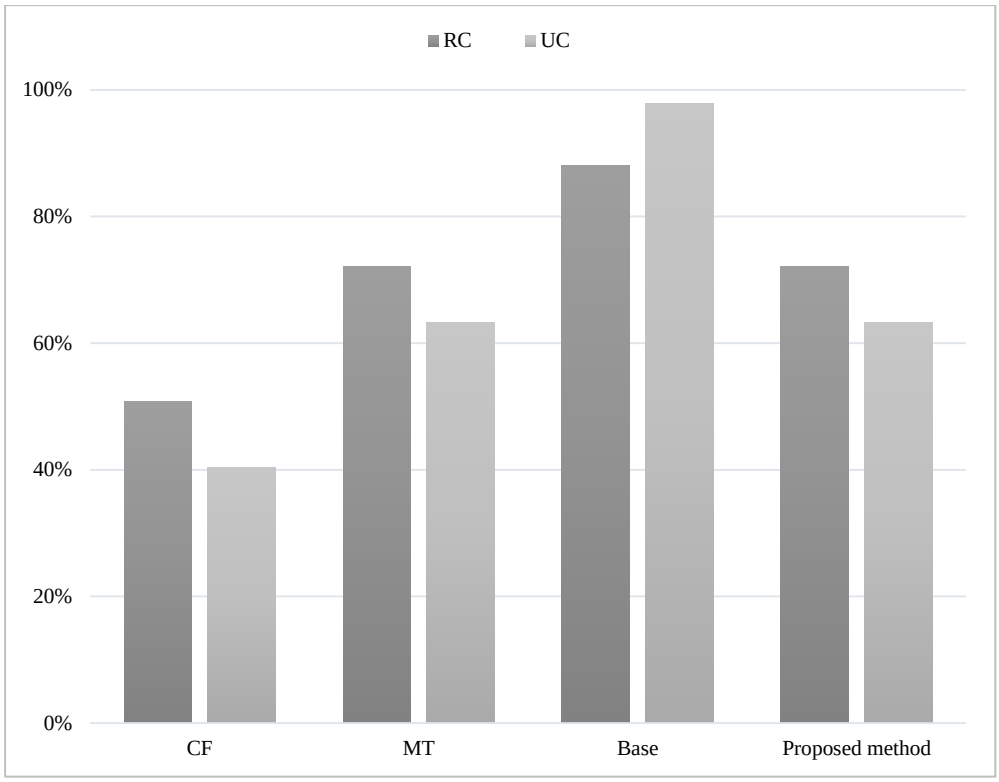

Figure 5.2: Description For All Users On The TripAdvisor Dataset, Evaluation Results Of The Suggested Technique Using The RC And UC Evaluation Criteria.

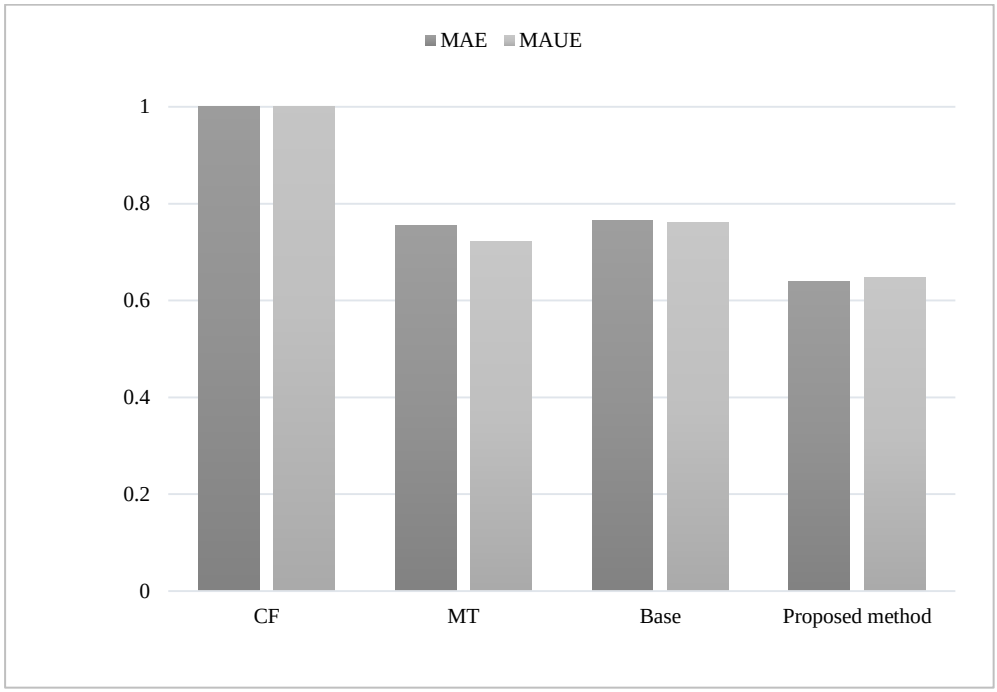

Figure 5.3: Description For All Users On The TripAdvisor Dataset, Evaluation Results Of The Suggested Technique Using The RC And UC Evaluation Criteria.

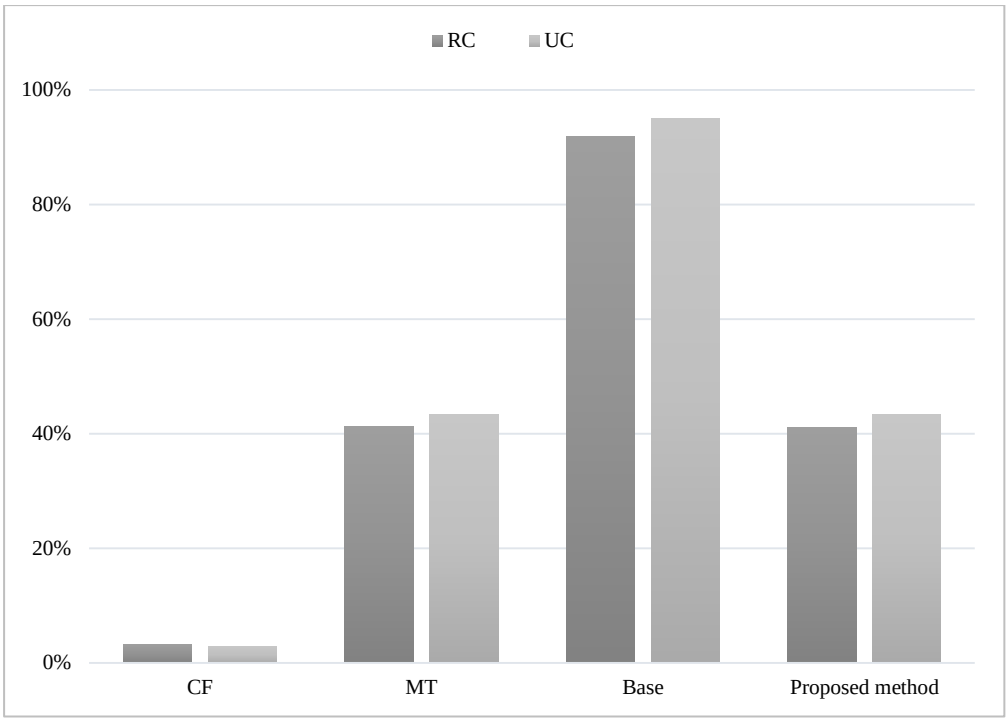

Figure 5.4: Results Of The Suggested Method Assessment For Cold Start Users On The TripAdvisor Dataset Using The RC And UC Evaluation Criteria

5.6 Analysis Of The Execution Time Of The Proposed Methods

In this section, we intend to compare the proposed methods with other methods in terms of execution time. It should be noted that in order to implement the proposed methods, we have used a system with a core-i5 processor and 4 GB of memory to perform the calculations. In addition, the tests will use the TripAdvisor and Netflix datasets and will show the amount of time spent on each datasheet according to the method used to predict the rankings. Also because of the large TripAdvisor database, given that the number of users in the Netflix database is equal to 1986. In the TripAdvisor database, only 1986 users have been used to calculate the execution time of different methods on the database. As shown in Figure 5-5, we see the execution times of different methods on the TripAdvisor and Netflix datasets.

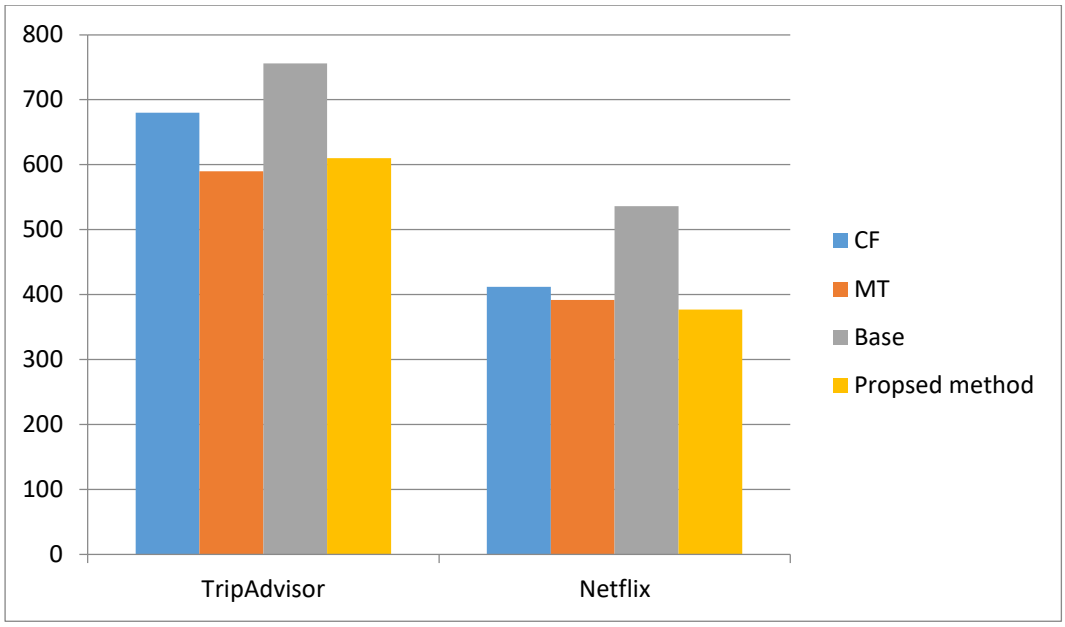

Figure 5.5: Comparison of Alternative Techniques' Execution Times with the Suggested Method (milliseconds)

Based on the results obtained on the execution time of different methods, among the compared methods, the MT method has less execution time compared to other methods due to the fact that it uses only trusted users of the active user to predict rankings. Also, the basic article method will be more computationally complex than the CF method, and this is related to finding users to master the method, which as an additional calculation has increased the execution time in this method compared to the MT method.

In fact, the results obtained on the execution time of different methods indicate that the use of additional social information in trust-based methods, in addition to increasing the efficiency of these systems, will increase the execution time. Therefore, in order to provide a suitable method, we need to maintain a balance between performance and execution time. In general, it can be said that the proposed method only has a higher execution time than the MT method, which if compared

with the accuracy of the proposed method with the MT method, it is clear that the proposed method has a much higher accuracy.

5.7 Summary

In this chapter, we performed different evaluations in order to review the results obtained in different ways. Also, the parameters that were effective in determining the results were examined with different values in order to determine the appropriate values for the parameters used based on the results. Then, based on the optimal values obtained for the parameters, the operation of predicting rankings for users was performed by the proposed methods. In fact, the proposed method was a trust-based method that performed better than other methods in predicting rankings based on the available results. Finally, the execution time of different methods was evaluated with the proposed method, in which the proposed method, in addition to accuracy and good coverage, had a better execution time than some methods.

Chapter 6

DISCUSSION AND CONCLUSION

6.1 Discussion

In the history of humankind, human beings have constantly moved and traveled for a variety of reasons. Tourism today is quite different from such movements and travels. As travel evolves, its composition, time, place, and effects change as well. Tourism refers to the act of leaving one's own environment and visiting another environment voluntarily. Today, Tourism is considered as one of the important tools in identifying national and cultural identity, education, income, growth and economic dynamism. The countries of the world have a special place and value, and different countries of the world are trying to use this feature to attract tourists from different countries to achieve their goals, as well as generate income and create employment. Tourism has a very important position in the world economy, as it is currently the third most lucrative industry after the oil and automobile industries and an essential component in a country's growth and progress.

Tourism is today considered to be an essential sector in economic development, since it offers high levels of development for the economic sector of many countries. In Malaysia, for example, tourism is considered as an economic catalyst and the main factors for its success are: development and planning. The development of tourism and related activities can lead to the creation of many jobs in the labor market and employment. Employment in hotels, restaurants, travel agencies, creating

jobs related to the tourism industry directly and indirectly and many other activities can create income and improve the social, economic, political and psychological situation.

Tourism as a socio-economic force is becoming one of the main pillars of the world business economy. In addition, many development planners and policy makers cite the tourism industry as a key element of sustainable development. Tourism is one of the world's most prosperous economic sectors, allowing the countries that have benefited from it by outfitting themselves with the appropriate infrastructure to also benefit. Tourism is a broad and cross-sectorial activity that takes place in various forms at the regional, national and international levels. Big data, processing capacity, and algorithms are crucial to Artificial Intelligence (AI). Each of these three elements has seen significant advancements in recent months as a result of several trends: first, the refinement and advancement of AI algorithms; second, significant improvements in processing capacities; and third, in the context of big data, the development of new and more powerful information sources and architectures that allow for the storage and processing of massive amounts of data.

The use of tourist recommendation systems to pick products that are reasonably compatible with the demands of users in the system has steadily expanded as the Internet has grown in popularity and the number of users in cyberspace has grown. In cyberspace, there are several instances of referral systems, particularly on e-commerce sites and social networking sites. The more recommending systems can provide better advice according to the users 'wishes and interests, the more users' acceptance of such systems will increase.

In this dissertation, the methods used in tourism recommendation systems, especially the solutions that use trust ratings between users to generate a proposal, are reviewed and analyzed. One of the most widely used methods of proposal production in tourism recommendation systems is the group refinement method. Such systems use the ranking matrix given to items by users in the system to generate a bid. The group filtering method, without knowing the content of the items, suggests items to users in the system that have been of interest to users similar to the target user. These methods use similarity criteria between users in order to find similar users to the target user. As the number of users and items in the system increases, the number of commonly rated items among users decreases, and in most cases, group refining methods are unable to find users similar to the target user in order to submit a proposal. One solution to this problem is to use trust relationships instead of similarity criteria in trust-based recommending systems. Trust-based recommendation systems create a trust network based on trust relationships between users for the target user, and in the process of generating a proposal for that target user, they use users who are in the target user trust network.

One of the challenges in referral systems is predicting user ratings with high accuracy. Because high-precision ranking prediction increases the efficiency of the recommender system in the production of the proposal and allows the presentation of recommendations in accordance with the interests of users. In other words, the closer the predicted rating for the target user is to the actual rating given by that user, the better the recommending system can identify the items of interest to the target user. As a result, users' satisfaction with the system will increase. The next issue in recommender systems is how to determine the target user's neighbor users. The better and more efficiently a referrer system can identify neighboring users of a

target user, the better it can predict the desired rankings. In fact, the degree of accuracy in predicting the rankings and coverage rate of a recommending system depends to a large extent on the correct and accurate determination of neighboring users for the target user.

In the proposed model-based method, a new clustering method is proposed to categorize users or items in the system. The proposed clustering method is based on graph theory and trust relationships between users and categorizes users or items in the system into different clusters. After clustering users or items in the system, the members in each cluster are used as neighbors used in the ranking prediction stage. This can largely solve the problem of neighborhood selection in recommender systems. Experiments performed to evaluate the proposed clustering method with other tested methods show that the proposed clustering method has achieved better results than other methods based on the evaluation criteria used.

6.2 Suggestions For Future Study

Despite the extensive research that has been done on recommendation systems, there is always room for new research. Here are some new suggestions on how to look or get an appointment for antique items.

One of the suggestions that can be made to improve the performance of the proposed methods based on the criterion of reliability and based on clustering, is the use of mistrust relationships along with trust relationships. Using trust relationships with trust relationships in order to obtain a better confidence measure will improve the accuracy of rating predictions in trust-based recommendation systems. In addition, by applying distrust relationships to the proposed clustering method, the proposed

method will be able to better categorize users or items in the system and thus increase system functionality.

Another suggestion that can be made about the proposed clustering method is to use fuzzy relationships to cluster users or items in the system. One of these solutions is to use the methods available in the Fuzzy C-Means clustering method. Using this method, users or items in the system can belong to several clusters with different degrees of belonging. In addition, using other graph theories to find users or important items in the system can lead to other applications in recommender systems, such as the concept of reputation.

6.3 Limitation Of The Work

The limitations of this research include the following:

- Difficult access to usable information sources and datasets
- The difficulty of providing and aggregating different datasets in this area
- Requires robust computing systems to implement the proposed method

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