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An Intensive Spectrum for Intention Mining Analysis

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Abstract— There is huge volume of data in the social networks. This data can be retrieved and integrated to extract useful meaning and come out with the insights which is called as intentions. This can be used in different fields like business, recommender systems, education, Scientific research, games, etc. Also, there are various intention mining techniques which can be applied to several fields as information retrieval, business, etc. There is no specific definition of intention mining and also there is very less existing literature present. Accordingly, there is need to conduct systematic literature review of the very recent research area. Understanding intention mining, purpose of intention mining, categories and techniques of intention mining is the need. The paper endorses a spectrum for intention mining so that further literature review of intention mining can be completed. We validate our work through dimensions, categories and techniques for intention mining.

Keywords- Intention, polarity, emotion, search intention, purchase intention, behavioral intention, natural language processing, machine learning.

I. INTRODUCTION

The concept of retrieving the text data from various sources and classifying into different categories so as to mine the intentions is increasingly becoming very vital in different areas of computer science. Keeping some intention in mind, a person performs action. Some people talk about and some of them write about what is in their mind [1]. The number of personal resources that a person is willing to commit to carrying out an action is known as intention strength. Intentional strength is similar to the idea of "motivation," with high levels of intention strength being thought to signify significant motivation to execute a behaviour [2]. Psychology has stated intentions as state of human mind to perform actions and also helps to characterize the intentions [3]. Intentions can be interpreted with two primary perceptions: i) A plan of action that a person or group of people wants to take, and ii) the aim behind certain actions or series of activities. The intention expressed in the following sentence has the first perception, “Sensational bating by Ishant.” But the intention expressed in the next sentence has second meaning, “Dale’s absence hurt the match series.” For the second type the intention is hidden and is unknown.

Natural language processing from a variety of sources, including text data from social networks like Twitter and Facebook, news blogs, logs, etc., can be used to infer intentions [4]. Different mining techniques are used for identifying the

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intentions. The research domain is entirely new and it is challenging to determine intentions from a piece of text data, and that to short messages. Short messages are usually short in length and are expressed in one sentence or even less. They may have spelling mistakes, short form of words, slangs and emoticons. Intelligent methods can be applied for text mining so as to extract knowledge and meaning data patterns from huge amount of unstructured text for making decision.

According to various groups, "intention mining" means different things. Synonyms for intention mining include intent, feelings, goal, aim, target, analysis, purpose, and many more. A survey of the literature on intention mining and how various computer science communities describe it is required. Natural language processing from a variety of sources, including text data from social networks like Twitter and Facebook, news blogs, logs, etc., can be used to infer intentions.

II. DEFINE RESEARCH QUESTIONS

The concept of intention was first introduced by Khodabandelou [5]. The research's objective is to discover the set of traits that will make it possible to compare the work on intention mining. By comparing the current comparison framework used in the field of software engineering, the available literature survey was analysed in order to develop research issues. [6,7], Information Systems [8], event-log based approach [9], Business related online reviews [10].

RQ1: What is intention mining?
RQ2: What are categories of Intention mining?
RQ3: How is Intention mining achieved?

Based on the research questions, intention mining framework is presented as useful way to discuss the systematic literature. The framework has three extents, which are identified as intention dimension, intention category dimension, and techniques used in intention mining [11,12,13,14].

Fig.1 shows the intention mining extents.

i) The intention dimension deals with the question, What is intention mining?
ii) The intention mining category dimension tries to define different classes of intentions.
iii) By providing the intention mining techniques the query How is intention mining achieved?

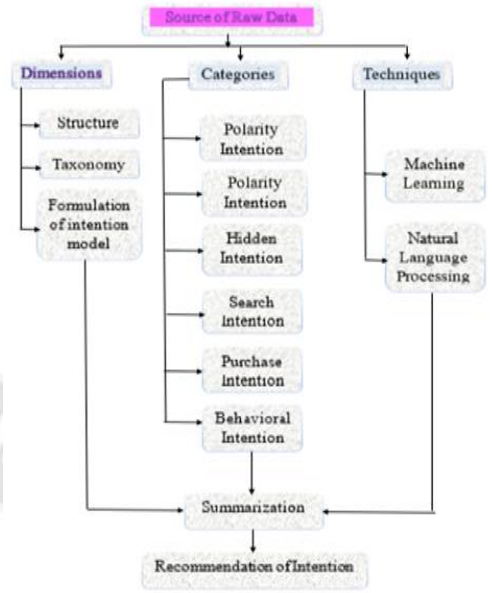

Figure 1. Framework extend of Intention Mining.

A. Intention Mining Dimension

The intention dimension has three attributes: structure of intention, taxonomy of intention, and formulation of intention model. It addresses the first research question RQ1: What is Intention Mining?

1) Structure of intention Mining

Individual intentions or a structured set of intentions can be identified. Each aim has the potential to be revealed or concealed [15,16,17]. Instead of using its name, it might be possible to describe the class of intention [18,19]. The specification of intention models is possible, though [20,21]. Intentions, including both good and negative contributions, are interdependent at the collection level. The primary structure of intents can be seen at the personal level, for example in the grammatical arrangement of words.

2) Taxonomy of Intention

The intention mining literature offers a number of definitions and taxonomies for intentions. It was suggested that actions and emotional assessments may be combined in a neurological theory built on semantic pointers [22,23]. It demonstrated how to ask computational questions about the connections between ideas and behaviour and psychological questions about human behaviour. [24] introduced multifaceted taxonomy to categorize queries sent to web search engines based on the query's intent, the kinds of entities it mentions, the kinds of words it uses, and the level of detail requested in the response. Based on 1000 actual questions submitted to online search engine allowed to understand user's intentions, objectives and anticipated

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outcomes. According to [25], an aim might be social when it is not about gathering information but about interacting with others, subjective when it is about gathering personal perspectives, or objective when it is about gathering factual facts. For [26] intent is purchasing intent. [27] defines intention as credibility and behavioural intention towards the reviewed product. We-intents are collective or group intentions that work together to accomplish a task. I-intention refers to I-mode, which is used just for personal purposes [28].

3) Forming Intention Model

For a person to develop entrepreneurial intents, regional features including population density, level of wealth, education, and employment in the public and manufacturing sectors are crucial [29]. The kernel extreme learning machine (KELM), which is based on the improved Harris hawk's optimizer (HHO), is a powerful intelligent model for forecasting entrepreneurial intent [30]. The Gaussian barebone (GB) technique is developed to enhance the HHO algorithm, hence strengthening the optimization capability for modifying the parameters of KELM and discovering the compact feature subsets. The best KELM model (GBHHO-KELM) is then created using the determined best parameters and feature subsets to forecast students' entrepreneurial desire. Map Miner Method (MMM) is a unique process mining technique [31]. Using process logs, this technique is intended to automate the creation of deliberate process models. The relationship between user activity logs and the methods used to achieve their goals is modelled by MMM using hidden Markov models. Additionally, the method contains two particular algorithms created to determine users' intentions and create an intentional process model (Map), correspondingly. Regarding the Map metamodel formalism, MMM may generate Map process models with various levels of abstraction. [32] studied the use of network analysis techniques and graph theory to understand the process through social commerce platforms. In addition to the fundamentals of network analysis, the suggested approach also models multi-layered networks, detects communities, attributes networks and applies motifs identification and analysis. An argument-based computational formalization is suggested [33], in which arguments serve as filters between stages and direct the movement of goals. Each of the four argument types is defined and associated with a certain stage of the goal-processing cycle. One the one hand, the arguments in the activation, deliberation, and checking phases operate as supports for a goal to progress to the next stage; as a result, if a goal has at least one strong supporting argument, it will become active, chosen, or executive, respectively. On the other side, during the review phase, objections act as attacks that stop a goal from being advanced. As a result, a goal will not prove to be pursuable if there is at least one strong opposing argument.

B. Intention Mining Categories

There is enormous amount of data in social network and there in increasing interest to apply intention mining in social networks. The intention mining category dimension can be with six attributes: polarity intention, emotion intention, hidden intention, search intention, purchase intention, behavioural intention [34,35,36,37].

1) Polarity Intention

Polarity intention is analysed from text data available in online documents such as comment review and blogs to classify it as positive, negative and neutral [38]. A technique for identifying the polarity of text data was put forth, using polarity features like (POS) Parts of Speech tags for nouns, adjectives, verbs, and adverbs. Sub-combinations of POS are able to identify certain syntactic details, providing more information about the word and aiding in the calculation of term scores throughout the categorization process

2) Emotion Intention

There is massive amount of unstructured data on social platforms. This data should be processed very rigorously so as to interpret human psychology [39]. In some cases, polarity intention is insufficient and hence emotions such as anger, disgust, fear, sadness, happy, surprise, joy, etc., needs to be detected in order to analyse the emotional or mental state of an individual. Social media data can be used in business sector to promote products and get feedback. It helps to improve the product quality and also service provided accordingly [40].

3) Hidden Intention

Machine learning and Artificial intelligence are playing very crucial role in interpreting human intentions. Toady AI systems can read and see, but still they cannot identify the hidden intentions in a piece of text data or from certain actions performed by human [41]. The task of identifying hidden intentions is challenging.

4) Search Intention

After giving query to the search engine, it returns the output related to the keyword. It is also called as query intention. Educational portals are viewed by students. Page views and Time on site are the indicators of student's intention so as to achieve academic goals in order to increase their grades [42]. It is difficult to analyse user intent for the queries given to the search engine because the data is sparse [43]. Data was collected from seven different transactional logs with three different search engines. The user queries are classified into three broad

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categories of user intent such as informational, navigational and transactional.[44] divided search queries into two categories as exploratory and lookup. The search results as well as the suggestion quality to alter the query can be improved if the specificity of the query is identified during run time. Expressing queries in few words is difficult. It involves users' intent dynamically and predicts users' future queries [45]. Retrieval system calculate similarities between documents and queries to find significant information. This has limitation that only single representation is generated, whereas it may have multiple meanings. Neural Multiple Intent representations model was proposed by [46] that generated semantically different query intents and their appropriate meanings.

5) Purchase Intention

Today the trend of online shopping has increased. People can buy anything at a single click. They first visit the online shopping site, browse the products, select it and then purchase it. The intention of the customer may be to purchase it or to just surf the web-pages. Purchase intentions helps the vendors to improve the quality of their products. The Deffuant-Weisbuch (D-W) model was introduced by [47] to explore the dynamic purchase intention or the users. Online shopping is very popular in developed countries and is now coming into practice in emerging countries. In order to forecast human behavior, the framework [48] contrasts important factors associated to the purchase decision-making process and their outcomes. The study by [49] looks at how young Chinese people's intentions to buy green cars relate to pro-environmental values, consumer values, and theories of planned behavior. Two pressing challenges in the realm of service research are service quality and customer intent to return. The two mechanisms support the upkeep of enduring client relationships [50]. The consumer purchase rules develop features and a plausible consumer purchase prediction intention are discovered through the visualization and processing of the existing consumer purchase data set. The purpose of the study [51] is to analyze the variables that influence Instagram purchases and the expansion of Instagram Commerce, as well as to look at the moderating effects of gender, age, and experience on Instagram usage in the proposed relationship between six variables derived from commitment-trust theory, the technology acceptance model, and consumer decision-making theory. Influential elements like entertainment value, irritation, and informativeness have an impact on social media advertising value and buy intent [52]. Online questionnaires were developed to and a survey was made to identify the effect of advertising on purchase intention. Consumers green product purchasing intention and how social media marketing and social media usage actively influence consumers sustainable consumption behaviour was aimed by [53]. Theory of planned behaviour was used to build a model to evaluate consumer green product purchasing intention.

6) Behavioural Intention

Online purchasing has embedded user behaviour. Prdicting user behaviour is time consuming and difficult. Statistical techniques, classification, clustering have tried to extract behaviour intentions. The process to identify and validate behavioral and normative beliefs and behavioral intent of people between 45-70 age limit who participated in shared decision-making in medically uncertain situations was described by [54]. A model built on TAM3 was evaluated in a learning environment [55]. The intention-behavior relationship was also investigated using the model, and the findings indicated that there is no meaningful correlation between intended system use and actual conduct. The psychological root causes of behavioral intention to use a P2P resource sharing platform online in a Swedish university context were investigated. Despite having strong environmental goals, the university does not encourage sustainable consumption among its personnel and students. So, based on the TPB, a behavioral model from a qualitative elicitation research was created [56].To forecast the elements influencing students' behavioral intention toward mobile learning from the perspective of consumers adopting the extended unified theory of acceptance and use of technology (UTAUT), a model was created and empirically tested[57]. In order to analyze the dataset, structural equation modeling was used. The model and hypothesis were tested using the partial least squares (PLS) method. When designing m-learning for use in universities, decision-makers and educational institutions could use the output of the UTAUT model as a useful practical reference. Behavioral intention distinguishes human behavior. High school students from the Surakarta district of Indonesia participated in a study [58] that sought to determine the elements influencing the specific degree of behavior intention from the standpoint of gender. The study's findings showed that high school students' behavioral intentions do not sufficiently encourage environmentally friendly behavior, and they also showed that there is no connection between behavioural intentions and gender that is significant.

C. Intention Mining Methods

The properties of machine learning and natural language processing can be used to develop intention mining algorithms.

1) Machine Learning Methods

Machine learning, a subfield of artificial intelligence, enables software systems to more correctly predict outcomes without explicit programming. For prediction, it makes use of historical data. Using machine learning algorithms like Decision-tree based ID3, Nave Bayes classifier, and Rule-based classifier on

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context-aware door dataset, [59] has attempted to predict the resident intentions. The basic approaches of machine learning are supervised machine learning and unsupervised machine learning. The use of probabilistic models to evaluate the most likely intentions behind traces of activities, specifically Hidden Markov Model (HMM)[60]. The authors contrasted user actions with the already-existing purposeful process model while concentrating on the supervised approach to determining the intentions underlying users' actions. [61] described the unsupervised discovery of intentional process models from event logs and introduced the Map Miner Method (MMM), a novel method for building intentional process models from event logs. They provided an example of a case study using MMM to explore the deliberate process related to the use of the Eclipse platform. The purposeful process models that were so obtained provide a fresh perspective on software operations and demonstrate their applicability to recommender systemsFlexPAISSeer, an unsupervised method for intention mining-oriented approach based on design science, was developed by [62]. Intent Recommender and Intent Miner are the two models that make up this system. Intentions are mined from executable processes using the unsupervised learning method by the intent miner. Based on the intent miner, the intent recommender mines the models of purposeful processes using probabilistic calculus and produces suggestions as intentions. To identify intentions from observed treatment actions, an investigation of unsupervised intention mining of complicated real-world medical procedures is described by [63]. To find multi-level intentions, a hierarchical hidden markov model (H-HMM) technique was developed. The scoring function for the H-HMM's state splitting approach was maximum a posteriori probability (MAP). Both qualitative and quantitative methods were utilized to assess the strategy using a case study of the trauma resuscitation procedure.

2) Natural Language Processing

To automatically categorize phrases into several categories, a convolution neural network (CNN) based method was put out by [64]. Di Sorbo et al.'s [65] taxonomy of intentions, which is divided into six categories—feature request, opinion asking, problem discovery, solution suggestion, information seeking, and information giving—was employed by the writers. The method enhances CNN by including batch normalization to quicken training and an automatic hyperparameter tuning method to adjust the proper hyperparameters of CNN. To convert public voice messages into text, [66] used Hidden Markov Models (HMM). Public general opinions were analyzed using natural language processing techniques. Fuzzy logic, part of speech, unigram, bigram, and trigram analysis, as well as pre-processing, were used to determine the appropriate user voice input. Two techniques were used in the research: (1) an automatic alert email and message sent to the neighbouring camp, and (2) a ticketing system for public and governmental officials to monitor. The authors developed a cutting-edge web and mobile-based smart application to automatically recognize public opinions and complaints using text mining techniques and detect COVID-19 from public audio signals. The patients were prevented from visiting the testing locations, which was a major factor in the spread of contamination, and it helped to detect covid-19 infection by speech. To determine the customer intent from online posts, n-grams, parts-of-speech, and support vector machines were coupled [67]. The writers came to the conclusion that dictionaries must be made and updated as new words are used online and that they are limited to a single language. Additionally, automatic dictionary improvement could be achieved via machine learning. A difficult difficulty is capturing a wide range of human intentions from a text [68]. The authors discovered the disadvantage of dependence on the similarity across intentions titles, which is that the knowledge base is redundant. Given the vast volume of data on social networks, they recommended using cloud computing to mine the web.

D. Construct Valadity

In the context of intention mining that RQ1: What is intention mining? is validated by intention dimensions. According to two authors [18, 19] intention mining can be discussed with classes. The taxonomy of intention is based on the questionaries' submitted to online search engine [24]. Different intention models are formulated such KELM [30], MMM [31], social commercial platforms. Many authors have worked on categories of intentions which is discussed using existing literature and validates the RQ2: What are categories of Intention mining? The intention mining techniques are discussed mainly machine learning and Natural language processing which shows the validity of RQ3: How intention mining is achieved? We selected IEEE Xplore, ACM, Springerlink, Sciencedirect, which shows the good quality of included articles.

E. Conclusions

A growing subject of study is intention mining. The paper suggests a frame work to classify intention mining. The classification suggests three views of intention mining based on the research questions: "What is intention mining?", "What are categories of intention?", and "How is intention mining achieved?" The study focuses on structure, taxonomy, categories and techniques of intention mining each dimension displays characteristics connected to a previous literature review. We concluded that our study will be helpful for a systematic literature review on intention mining after validating our approach by citing high-quality, cited work. In order to identify

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aims, our next step is to publish a thorough evaluation of the literature.

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