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Expert System for Identifying Great Personalities Using Fuzzy Logic and Deductive Reasoning

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ABSTRACT:

During any interview or purchasing a product the choice of questions made is very crucial. To identify the minimal set of questions reduces the time for interaction. The aim is to identify the great personality or the character which the user thinks of. The methodology adopted is using a decision tree to map the answers provided by the user and the features for the character stored in the database. The prediction of the character maintains Fuzzy values depicting the surety of the output and Reinforcement learning to adjust the probability with atmost accuracy. Features are extracted by the physical characteristics and field of work the characters are. The developed model is an expert system aiming to guess a character selected by the user from the database.

INTRODUCTION

The model presents set of questions to identify a great personality based on the features of the characters. The features are the facts and the information available. The System identifies characters based on Fuzzy Logic to simulate Deductive Reasoning. Deductive reasoning is the process of validating the conclusion with the help of available facts and information.

The task is to identify a personality based on decision trees with the minimal set of questions. The features are extracted by the facts and information available through the extensive research. The features are provided with the fuzzy values. The practical application can be related to recommendation systems and also eye witness identification or expertise selection. In case of recommended systems, based on the previous searches and history system recommends the related products to the user.

Also extended to crime scene analysis in the field of forensic and crime. Where classifying and identifying a person based on the features and the evidences obtained.

The system also implements the answering the questions either through gestures or through voice inputs.

LITERATURE REVIEW

The literature survey includes the work done by the authors and researches in the Expert system to guess a character and studied algorithms proposed by various authors.

In [1] Adrian Groza, Lordena Coroamă authors presented the idea of guessing a character based on the features which are extracted from the images. The software agent aim to guess a

character selected by the user from a DBpedia(DataBasepedia) image. The algorithm used by this paper is image processing capabilities and greedy-based metrics to select the best question for the current state. The agent only deals with only yes or no anwers and assuming user provides correct answers. Another gap identified is features are extracted only based on the provided images.

In Reinforcement Learning in 20Q Game with Generic Knowledge Bases [2] paper presented by authors, Chun Hei Lo, Luyang Lin, implemented a Reinforcement Learning framework for the 20Q game under a Markov Decision Process formulation and also extended the application to general question-answering when the relevant knowledge is supplied by a knowledge base. The major drawback identified are knowledge not present n the database is set to false by default and Is-a relation doesn't exist between concepts.

The authors in [3] Xianchao Wu, Huang Hu, Momo Klyen, Kyohei Tomita, Zhan Chen introduced a novel introduced a novel puzzle riddling framework for an emotional chatbot, called Rinna.Designed entropy-based question ranking and role ranking algorithms for filtering question selection. The methodology used in filtering the question selection based on designed entropy-based question ranking and role ranking algorithms. And also proposed a multi-class classifier making use of MLP for automatically determining probabilities of relations between two questions. The future scope identified to update the entropy-based ranking algorithms by Deep Reinforcement Learning algorithms. And dynamically learning the action (question selection, candidate role sorting) ranking policies.

In [4], the author Sunith Raj Suresh developed an algorithm that utilizes a Bayesian strategy to determine a sequence of questions to play the 20 Question game. The goal of the questioner is to correctly guess the item by asking up to 20 questions and not more tthan 20 questions to identify a character. The gaps identified in the work was that user may not know the correct answer to binary questions regarding every feature of all item. The algorithm is step-wise greedy and not guaranteed to be optimal and does not allow wrong inputs by the user.

Authors Huang Hu , Xian Chao Wu , Bingeing Luo , Chong yang Tao , Can Xu , Wei Wu and Zhan Chen in [5] proposed a novel policy-based Reinforcement Learning (RL) method, which enables the questioner agent to learn the optimal policy of question selection.

RL method is robust to noisy answers and does not rely on the Knowledge Base of objects.

The main draw back identified was the construction of the state transition dynamics is a long, tedious and requires manual work.

In [6], presented by authors Zachary Henkel, Cindy L. Bethel, John Kelly, Alexis Jones, Kristen Stives, Zach Buchanan, Deborah K Eakin, David C May, Melinda Pilkington implemented a character guessing game that had duration of five to seven minutes, in which a Nao robot asked each participant a series of questions to identity of a fictional or non-fictional character. The character guessing game was not manipulated in any systematic way and the sample size was small given the potential set of outcomes was the main gap identified in this work.

In Knowing What to Ask: A Bayesian Active Learning Approach to the Surveying Problem [7] written by authors Yoad Loewenberg , Yoram Bachrach, Ulrich Paquet, Jeffrey S. Rosenshein

presents an algorithm proposed to solving it using the DRAL model. Approach with alternatives based on augmented linear regression. There were two main gaps identified in the project were the model does not achieve good performance and robustness to data loss in other domains and also Non- Bayesian approaches, perhaps not based on linear regression can achieve comparable performance.

The authors Ido Guy, Adam Perer, Tal Daniel, Ohad Greenshpan, Itai Turbahn in [8] implemented an algorithm that can rapidly extract large amounts of relationships and tags that are both diverse and valid. And also he algorithm collects relationships as input in comparison to tags. An important unique feature or mechanisms, such as a scoring function that includes dividend points. The difference identified in the algorithm is to explore ways to exploit the data collected through the game. And Investigate refinements of the scoring function, means for longer-term engagement, and methods for privacy preservation.

PROPOSED SYSTEM

The proposed expert system identifies a real great personality or a character based on the features. The system will be able to receive inputs from either the camera or the microphone. The model retrace its steps if in case of any wrong entries and also verifies the character with the user and accept new inputs if in case of character not existing in the database.

The methodology adopted by the model is the decision tree for mapping answers to the persons/characters and their features. During and after the prediction of the characters based on their features maintains Fuzzy values depicting the surety of the output. And also using Reinforcement Learning to adjust the output probability with atmost accuracy.

The proposed model predict the character within 5 seconds of time. Also accommodates and supports with increasing in database.

SYSTEM DESIGN

The architecture of the system is relatively easy having 3 major components to work together.

1. Input component: This component is responsible for activating one of the types of input and blocking others from interfering with the system. The component accepts input as gestures, voice and cursor. Also responsible for recognizing the voice input and to recognize the gestures made by the user.
2. Deducing component: This component is the brain of the system that asks the right questions to the users and can act intelligently based on the user input. After each answer made by the user this components start asking the next question based on its previous experiences and tries to makes the guess with least number of questions.
3. Measuring component : This component helps the deducing component to reveal the answers. This component consists of a fuzzy function which is mapped to all he data in the dataset after each answer from the user. This component is also responsible for accepting new character inputs form the user and also cutting off the deducing process if in case the specified requirements are met.

For the high level design use case for the system is defined. User as an actor communicates with the system, where system identifies a great personality based on the input to the questions.

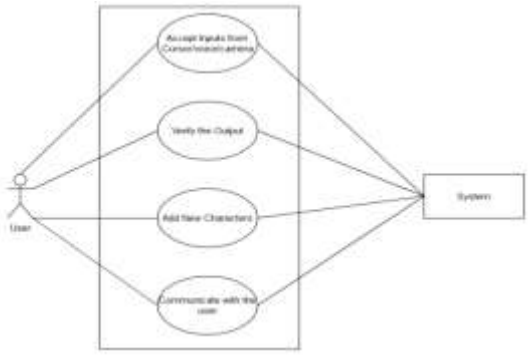

Fig : Use case Diagram for an expert system to identify Great personality

There are two actors one is user and other one is the system which responds to user.

User the one who plays and the system one which identifies the Great personality based on the inputs provided.

The 4 Use cases defined are accept input through the means of cursor or voice or camera gestures, verify the output, add new characters and communicate with the user.

- Accept input – Input from the user for a specified question can be through the means of the cursor or through the voice commands or even through the camera by making the gestures like thumbs up or thumbs down.
- Verifying the output – The character identification can be verified by both system and the user. System using decision trees matches the character and identifies the character. The user also verifies if the character identified is correct.

If the correct answer not identified or if the character not in the provided database, then system asks the user to add the character to the database, so that the database can be extended.

System communication is an another important functionality maintained. Each question needs to be answered by the suitable means which user chooses to identify the character.

Data Flow Diagram provides the functional overview of a system. The graphical representation easily overcomes any gap between user and system analyst and analyst and system designer in understanding a system. Starting from an overview of the system it explores detailed design of a system through a hierarchy. DFD shows the external entities from which data flows into the process and also the other flows of data within a system. It also includes the transformations of data flow by the process and the data stores to read or write a data.

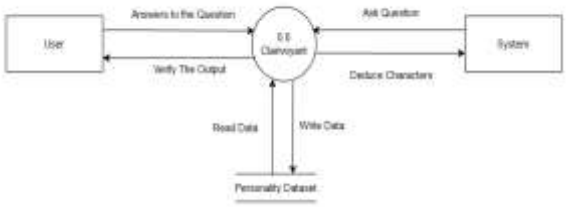

Fig : Data Flow Diagram – Level 0

Level 0 is also called as context diagram, where all the process are shown in one single process.

The single process called as clairvoyant interacts with the user as the system asks questions to the user and based on the input verifies the output and identifies the character. The decision tree deduce the character list based on the features stored in personality data. If the character not identified or stored in database, system asks user to enter the character details which will be stored in the database.

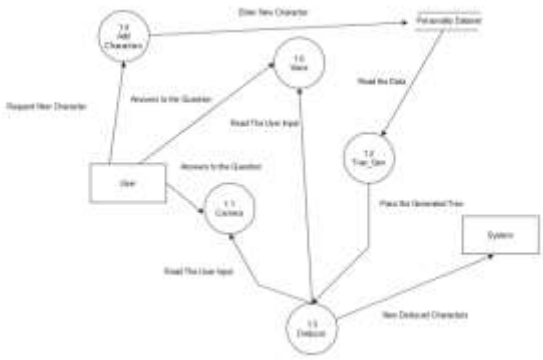

Fig : Data Flow Diagram – Level 1

In level 1, the process split into 4 process – input through voice or camera and tree generation , deduce the tree and add characters.

Input from the user is taken either through camera gestures or through the voice commands. Input values produces the decision tree based on the fuzzy values. Then deduce the tree to the ouput ie to identify character based on the user input values. If the character not identified or not stored in the database add the characters to the personality database.

IMPLEMENTATION

The implementation of the above mentioned designs contains 3 modules.

Data Collection and Preprocessing : The system needs a vast list of characters to work with. No dataset were readily available. The dataset was built through extensively searching across the web. The dataset currently consists of 100 characters with a custom fit features that has unique set of values for all the character. The dataset has the potential to grow as player plays. There were 2 preprocessing applies to the dataset. Initially as the model started training, the features which had zero entropy were dropped. Secondly, the dataset was filled with a fuzzy value of 0.5 in the field where features were not known during the search for the character.

Model development : the model uses a custom developed algorithm which focuses on splitting the data with the help of the entropy. The entropy determines the difference between all the individual sets of characters. The model focuses on two important things , No features pruning until the entropy for the feature is zero and unlike the regular decision tree, the model focuses on dropping off the tree when certain specifications are met. The model uses surety index that determines how sure the model is that the user is thinking if the character. The surety index is a fuzzy value.

Interface development : The frontend interface was developed with the help of tkinter, which is an inbuilt library in python. 100 Great persons and characters physical characteristics, their field of work and the contribution given, based on all these characteristics features are extracted.

Features extracted are through the analysis and the facts known about the persons. These features are fed as questions to the user to identify character.

RESULTS AND ANALYSIS

Testing phase is very important phase in system developing. No software is assumed to complete until it is tested and elaborated test data is prepared and the system is tested using that test data.

Unit testing is applied to each particular module that is if the input is taken by cursor, gesture input properly accepted and read by camera and voice commands.

To train the expert system dataset used initially of 100 characters. And increased to 400 characters.

Users of the system are students, faculties are allowed to test the system and verified with the proper output. All the defined functions are specified according to the user.

Beta Testing is done by the real users with special features like geatures and voice command inputs communication are verified.

The integration testing applied on all modules and integrated, checked the communication by applying integration testing. Integrated all the modules that is cursor, camera and voice command inputs and tested for communication of the agent with the user.With the extended dataset also the system integrated and validated.

The system testing done by verifying and validating the system. Interaction of the agent and the user communication properly defined. The functional and non functional requirements for the system are verified and validated with proper results.

Based on the input from user, the system asks the question and identifies the character.

Some characteristics of some great personalities can be same. Based on that system asks or guess the character. If the character identified is not the one user thinking, the user can provide answers that is not the character thinking of. Then the system will asks more specified questions to deduce the decision tree and displays the final output. If the charcter not identified or charcter not exists in the database then the user will be asked to enter the charcter they are thinking of to the database.

The input to the system can be through three means.

One is cursor – where user by moving or clicking the answer displayed can answer a particular question.

Second is camera – User can show gestures with the use of camera like thumbs up or thumbs down. The gestures shown will be interpreted as answer and relatively maps to the fuzzy logic values and displays the answer.

Third is voice command – User can enter the answers through the voice input. The voice interpreter displays the answer and identifies the character.

If in case user entered any wrong answer by mistake or without prior knowledge they can visit the previous question and change the answer proceed.

Fig : The UI of the system to identify the characters.

The 4 buttons on the rightmost corner refers to the input from the user. User can input the answers as through voice command or through the gestures using the camera or even through the cursor. The correct option is used to edit the previous question answer in case of any disperency in entering the answers.

The answers can be taken as fuzzy values –

- yes
- No
- don’t know
- probably
- probably not

The space provided will display the output that which character is the user thinking. User can verify that if the not character identified then the system will ask the user to enter the character details to be entered in the database. The Yes or no will be used by user to verify the character identified correct or not.

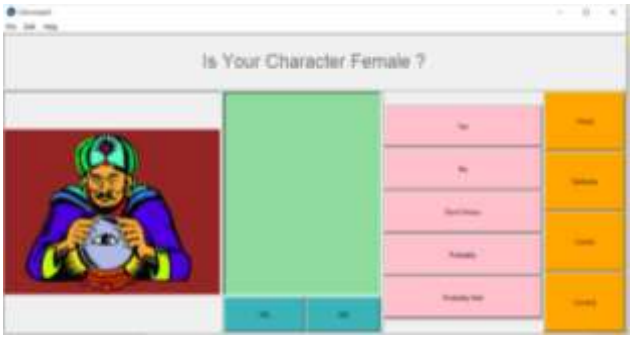

Fig : UI which displays the question to the user

The input values are fuzzy logic values accepts. Based on the input the given from user and dataset, the system calculates the entropy and produces a decision tree, which will be viewed as a random forest. As the input values goes on the decision tree constructed provide the result based on the features and the calculated surety index. One leaf node will be selected based on the character features and displays as the output.

CONCLUSION AND FUTURE WORK

The model developed was an expert agent aiming to guess a character selected by the user from a database. The agent is empowered and trained with processing capabilities and greedy-based metrics to select the best question for the current state.

The system can be extended in the future , as the approaches to extend the work, the system currently asks the question on a random basis which can be extended in the future to work based on probability. The probability can be implemented using Baye's Theorem which will in turn implement conditional probability. This will recommend the system to ask the next better question and act as a recommender system. The probability values can be altered with the help of reinforcement learning when deployed as a web application.

The work can be extended based on probability where currently asks the question on a random basis. And other implementations that can be referred or extended for future scope are identified.

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