Developing Robot Behavior as Travel Agent for: Social Interaction

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***Abstract*—** Today social robots possible to perform roles of elder care, personal familiar, hotel caretaker, and in day-to-day interaction, and with the cost-electiveness of automation, this trend is now popular. However, one of the problem of introducing robots to new domains is the creation of social interaction logic, which principle how the robot behaves and interacts with people. It is tedious for an interaction designer to create all the behaviors for a robot by hand, and it is an incredibly challenging task to expect all the varieties of ways that humans may behave in a social interaction. To solve the problem of responding to human actions, a fuzzywuzzy logic [fig 5] algorithm with pandas data frame can be used. The system trained human-readable rules that prescribe which action the robot should take, based on taking input from designer(conversation data take from csv table [table 4] && [table 5]). In this system the above technique is can be applied to the robot learns to play the role of a travel agent.

Keywords: Neural network sensor, speech matching, cluster data.

I. INTRODUCTION

sociable robot can be perform some social tasks such as sympathy to elders, can act as a tutor for children, can perform a task of a teacher as well as student in order to help in ASD (autism spectrum disorder), and can be a home assistant. It should be able to understand people and itself in social terms. It should be able to communicate and interact with humans and most important in social robots is it must looks like a human being. Some social robot application. Robot as Travel agent, Robot as teacher & Robot for elder.

Today social robots possible to perform roles of elder care, personal familiar, hotel caretaker, and in day to-day interaction, however, one of the problem of introducing robots to new domains is the creation of social interaction logic, which principle how the robot behaves and interacts with people. It is tedious for an interaction designer to create all the behaviours for a robot to social interaction. To solve the problem of responding to human actions, devise hierarchical clustering algorithm and fuzzy algorithm can be use.

For that can be use a clustering Algorithm[table I] based on action co-occurrence frequencies By imitation learning based approach the imitation learning based approach for the development of robot interaction logic, from Natural human interaction data. We develop robot interaction logic by two approaches. First is:

Development of robot interaction logic, from Natural human interaction data can be collected with sensor network sin target environments, like stores and offices. Machine-learning algorithms can then be applied to this data to train a robot to take the place of one of the humans by imitating their behavior. For example, by passively collecting data from natural interactions in a travel agency, a robot could learn how to become a travel agent. With an imitation-learning approach, it is possible for a robot to learn the correct responses to unambiguous human actions. In that technique robot give correct response without taking input from designer. Here robot cluster his input data by its own using machine learning algorithm [] table 1. Machine learning is the science of creating algorithms of a programmed which learn on their own. Once designed, they do not need a human to become a better. Machine learning usually works with huge chunk of data.

The second approach to develop robot interaction logic from natural human interaction with taking input from designer which cluster data of human interaction. For that can be use python pandas library file.

These files provide the csv file structure which is useful for cluster data. The pandas provide sql like pandas query (q1). So effective and correct data can be derived from cluster data file using pandas query. We use second way\approach do develop travel agent.

II. LITERATURE SURVEY

L. A. Zadeh used basic characteristics of a fuzzy implication function[ref 5]: fundamental property ,smoothness property, unrestricted inference, symmetry of generalized modus ponens and generalized modus tollens, ratio ,process extract and a measure of propagation of fuzziness[fig 5].

Dylan F.Glas a Research Intern with the Advanced Telecommunications in 2013s. For that he used clustering algorithm [ref 4]. It is done by using machine learning approach. This approach work on human to human interaction data.

III. REQUIRED MODULES

A. *Data Processing*

The customer speech are first applied to identify the segments of robot interaction from cluster data that in text format. The customer speech segment is in audio format. So the customer speech segments were passed through a voice-to-text [module 1] to convert into text format.

Fig. 1: text to voice module

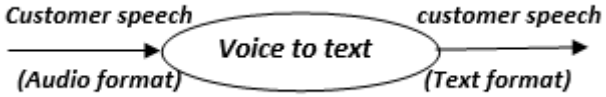

Fig. 2: voice to text module

B. *Speech Action matching:*

In the proposed module, a customer's action is recognized by their utterance text and matches this text in cluster data for correct response of travel agent. For that used fuzzy logic

algorithm [6]. Here customer interact with agent by his natural language. So avoid the spelling mistake between customer speech and cluster data fuzzy logic [5] is used. The fuzzy return matching deference between two strings. By taking this deference can be decided speech match or not.

C. Speech Cluster

The panda's csv file is used to store the cluster data of travel agent and customer. In that file text formatted data cluster in table. Customer [table 4] and travel agent [table 5] utterances were clustered separately since their actions did not frequently overlap and its correlated by providing speech ids.

D. Robot Action Prediction

A robot system must decide which action to take next. In the proposed system, this robot action prediction is accomplished by learning a set of human-readable interaction rules from the sequences of speech action IDs in the human–human interaction training data. Action (speech cluster) IDs are discrete, symbolic representations of abstract actions [table 4&5]. First from the customer table of cluster file by matching customer speech, speech ids are accessed then through the speech id using pandas query correct and effective travel agent text formatted utterance are retrieved from agent cluster data which is cluster in csv file.

IV. INPUT DATA FOR TRAVEL AGENT

Previously natural human-human interactive data is collected by using first module that is Data collection then this Data is converted from Audio to text format by using Data processing method [2]. After that used .pandas csv file to cluster data. Customer and travel agent utterances were clustered separately since their actions did not overlap. The customer and travel agent text formatted speech store in table. Each and every text formatted clustered speech provide the speech ids. Here speech ids use to co-relate travel agent and customer interaction data.

Then this cluster data give as input to travel agent through the pandas query (q1) by mapping speech id related cluster utterance. This is done through the robot action method.

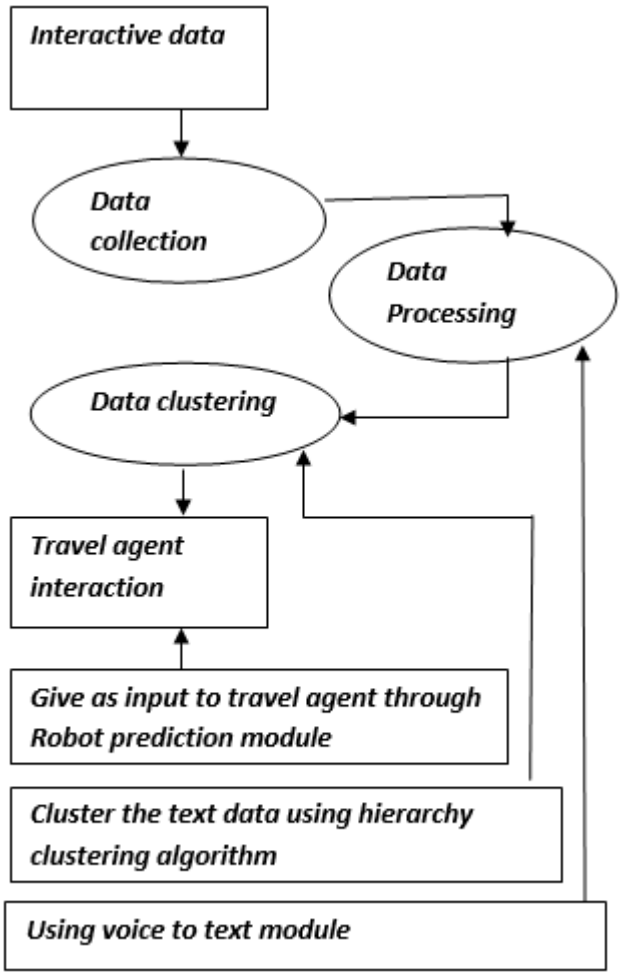

Fig. 3: Input to travel agent

V. INTERACTION BETWEEN TRAVEL AGENT AND CUSTOMER

First customer interact with travel agent by his questionnaires then this voice is converted into text format using data processing module [2] and it provide to the speech action matcher to find the closet speech cluster By using fuzzy logic [6] module after that gives to the robot action predictor for Give the correct response To customer questionnaires then this data again convert into audio format again convert into audio format.

The speech action matcher module match the customer speech with cluster data .This data is already cluster by pandas csv cluster file and its given as input to travel agent [3] through the pandas query the travel agent and customer speech are cluster separately and they are correlated by using speech ids. Using speech id retrieve (q1) the correct speech for travel agent its done the robot action predictor module and gives to the text to voice module [fig 1]

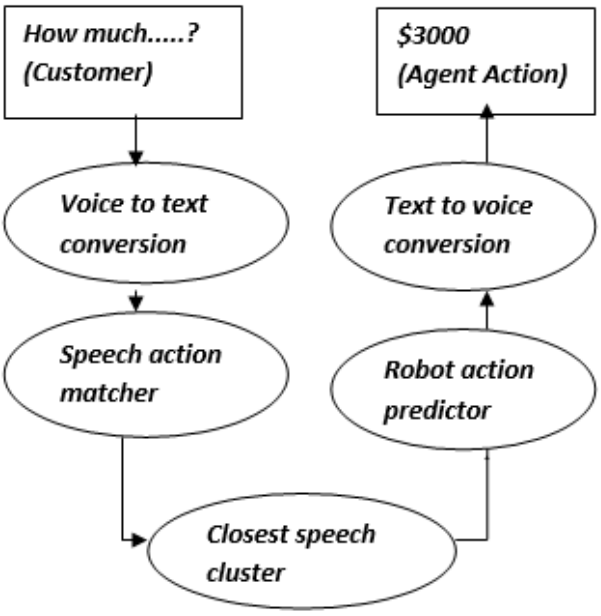

Fig. 4: customer and travel Agent interaction

VI. PANDAS DATA FRAME

(With taking input from designer)

To the cluster data use pandas csv file. By using pandas query can be retrieve travel agent speech. Here customer and travel agent speech cluster separately and they are co-related with speech id. Example

Customer speech	Speech_id
Which area covered	05
How much …….?	06
……etc	……n

Table IV: customer clustered speech (c_data)

Agent speech	Speech_ id
$3000	06
Under Maharashtra	05
……etc	……n

Table V: travel agent clustered speech (a_data)

1) First customer interact with travel agent by his questionnaires then this voice is converted into text format using data processing module and it provide to the speech action matcher to find the closet speech cluster By using fuzzy process extract module[fig 6] .
2) Fuzzy process extract module gives the matching ratio between 0 to100. E.g.;

```
t=process.extract(s, customer_speech)
```

Where,
s is customer text formatted speech
customer speech is customer cluster data
t return most matching result from customer speech
#consider s is "covered areas" then t return the ratio like 80 with most matching string

```
r=c_data ['customer_speech']==t][
'speech_id']
```

(Query 1) # retrive respective speech id from customer cluster data is that r=05 using pandas query

#Then through the pandas query by providing speech-id that is 05, retrive respective travel agent Speech from agent cluster data.

```
p=a_data ['speech_id']==r][
'agent_speech']
text_to_voice_module(p)
```

#output under Maharashtra

VII. HIERARCHICAL CLUSTERING ALGORITHM

(Without taking input from designer)

Supp Support matrix
T Set of topic clusters £ ∈ T
£ Set of action a ∈ £
Input:supp
1) Supp'<-filter(supp,⊖1)
2) T<-initialise_topic_clusters(supp', ⊖2)
3) zWhile stop_condition_not_met():
4) Add action to ∝to topic £ that meet fit criteria using ⊖3 and⊖4
5) Topicfit<compute_action_to_topic_fit (supp' , T)
6) Remove all action from topic cluster that do not meet fit criteria using ⊖3 and ⊖4.
7) Return T

Table I: clustering Algorithm

speech cluster ids	Typical utterance	Speech cluster size
2001	Hello.	61
3050	Hi there, how I can help you?	30
3004	Will ring you up at the next counter.	55
2006	Can you tell me more about Sahara desert?	40
2015	Okay, how much is that one?	40
3008	That is $3000	49
2048	Okay. I guess I will take trip to London	25

Table II: Examples from the Space of Learned Actions

Travel agent speech cluster 3047	
customer	The camel that you be trevling up in your camel carvan
	Look up the camel
	Camel selfies
	I will be crossing by camel CARVAN
	It will last for 14 night and you will be traveling by camel carvan
	Well you could you will be traveling by camel carvan I should say
	Well you will be with lot of camel and five for other two arrests
Typical utterance;" you be traveling by camel carvan"	

Table III: Example of a Speech Cluster

aC is the preceding customer action.
ATA is the set of all possible travel agent actions
P(a|aC) is the transition probability from aC to a.
a is the robot's action

$$aTA = \underset{a \in ATA}{\operatorname{argmax}} P(a|aC) \quad (1)$$

(1)use to find travel agent action. During operation of the system, after predicting the action aTA, the robot speaks the typical utterance (bottom of Table II) of the corresponding speech cluster.

$$Supp(ai,a\,j) = \frac{|\{h \in H;\ (ai,a\,j) \subseteq h\}|}{|H|} \quad (2)$$

With (2) a support matrix, Supp, was generated representing the support of all possible pairs of actions, $Supp \in R|AC \cup ATA| \times |AC \cup ATA| \geq 0$, where AC is the set of all customer actions and ATA is the set of all travel agent (robot) actions.

$$Fit(a,\tau) = \frac{a\tau \in \tau\ Supp(a,a\tau)}{\tau \in T\ a\tau \in \tau\ Supp(a,a\tau)} \quad (3)$$

During the Add subroutine(Step4) in (table I),all actions a that meet two criteria are added to the topic cluster they best fit, τbest. First, in order to assign actions to their best-fit clusters the action a should match to τ best above a Fit threshold, θ3. Second, to exclude ambiguous actions, the action a should fit τ best at least θ4 times better than any other cluster. The second subroutine, Remove (Step 6), removes all actions from topic clusters that do not meet the above criteria.

$$Ptrans(a,\tau) = \frac{|\{at;\ at = a \wedge aTA,t+1 \in \tau\}|}{|\{at;\ at = a\}|} \quad (4)$$

using (4). Since customer actions are often ambiguous , the transition probabilities were based on the topic of the next travel agent action, which provided more information about the topic of conversation.

$$aTA,t = \underset{a \in ATA}{\operatorname{argmax}} P(a|aC,t,s\,t) \quad (5)$$

(5) predict the the most frequent travel agent action observed following that pair in the training data is returned.

VIII. FUZYY LOGIC MODULE

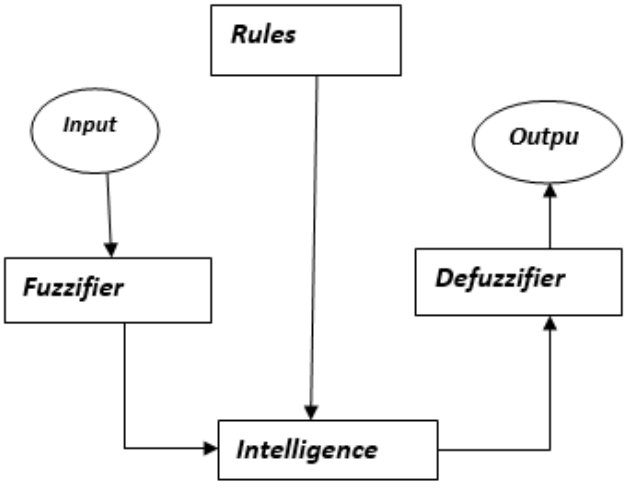

Fig. 5: fuzzy Logic Architecture

1) Knowledge Base: Its stores if-then rules provide by the experts.
2) Interface Engine: it simulate the human reasoning process by making fuzzy interface on the inputs and if-then rules.
3) Defuzzification: Its transfer the fuzzy set obtained by the interface engine into value.

Fuzzywuzzy is python predefine library file its provide many module for string matching like ratio, process extract ,Simple compare, Using difflib. In that project use fuzz ratio module. Its module return the deference ratio between two string between 0 to 100. If ratio return the grater then 55% then we consider string get match because customer incoming string is in natural language format. so there is many chances of spelling mistakes between customer speech and cluster data.

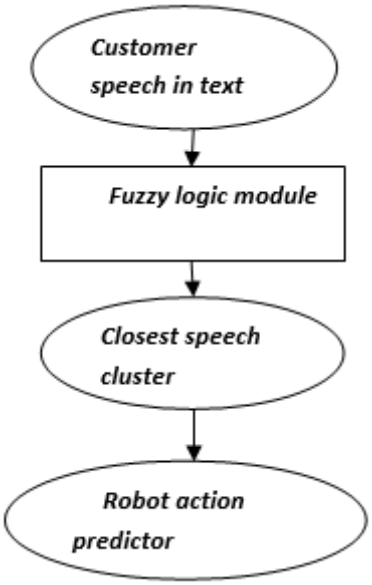

Fig. 6: fuzzy logic module to match the txt with cluster

First customer interact with travel agent by his questionnaires then this voice is converted into text format using data processing module[2] and it provide to the speech action matcher to find the closet speech cluster By using fuzzy logic module[6] after that gives to the robot action predictor for Give the correct response to customer questionnaires then this data again convert into audio format using Data processing module[1] and its give to travel agent for response.

IX. FUTURE SCOPE

Sociable robot can be perform some social tasks such as sympathy to elders, can act as a tutor for children, can perform a task of a teacher and can be a home assistant. It should be able to understand people and itself in social terms. It should be able to communicate and interact with humans and most important in social robots is it must looks like a human being. Some social robot application.....Robot as Travel agent, Robot as teacher, Robot for elder.

X. ACKNOWLEDGEMENT

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XI. CONCLUSION

This study presented a technique for learning social robot interaction behaviors, in the form of human readable rules,

from human–human interaction. Additionally, a fuzzywuzzy logic algorithm was introduced that discovered topics

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