Assist Robot

Project Report

Project Team – 8

Team Members

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Table of Contents

1. Introduction:

The main goal of the project is to help people in finding their misplaced objects. Basically humans have a tendency to forget their belongings somewhere in their house and search for it for hours together. For example, if I have an important business meeting to attend, but I don't remember where I placed my car keys, then I will be in huge loss. So to prevail in these circumstances here comes our Friendly Robot- My Friend which could assist me in keeping track of my personal things. So what this robot will do is that it will have entire map (laser scan) of the building and objects in the building in its memory. So we will feed the robot with the objects that are highly important to us, like car keys, some files, phone and laptop. This robot will keep its eye on these objects and notify their location to its master upon request.Additionally, our Robot who will be an eFriend who will help us to choose the furniture to our home. Also our robot will suggest us the top rated books.

1.1Project Goal and Objectives:

The primary goals of our project is described below:

- To implement a module which has an interaction with robot. E.g. You can ask few questions to the robot and the Robot will be responding to you back. You can ask the robot about your misplaced phone. So that it will answer you after it had found the phone.
- To make the robot learn about the personal items like chargers, phones, watch, keys etc.
- To design a robot which can find the learned objects that are misplaced in a building.
- To build a recommendation system which will be able to recommend the list of books which are rated high and are related to our interests.

- To build a recommendation system which will suggest us about the latest furniture details, their quality and from which brand/ shop we could purchase from. This feature enables us to decorate our houses with rich interior designing.
- To send a notification to your smart watch when it finds the lost object.
- To remind the user about his day to day events that were previously taught.
- To make the robot act as an assistant in getting things specified by the user. (Mr Robot – Get me my phone).
- To make a single robot act as assistant to all the people living in same house. It recognizes the user first and then assists that particular user in finding the belongings.

2. Solutions

In order to achieve the goals of this project we might have to use the techniques of machine learning, a few of natural language processing algorithms. The machine will be fed with the testing and training data sets with which it must build its own capability of decision making.

2.1 Architecture

User will be interacting with the Robot/Android Device communicating his/ her requirements and then the requirement of the user will be streamed to spark where decision making takes place and the results will be sent back to the user's device.
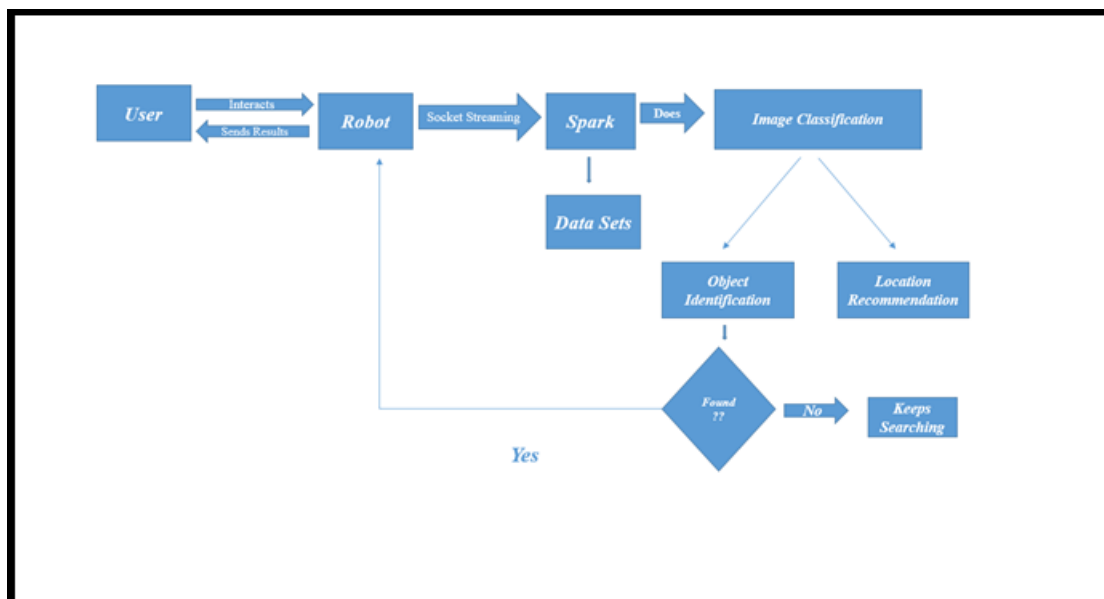
The above work flow is justified in the project by the way the user interaction with the Android device happens through the login page where the user need to feed the images manually for which we had implemented a camera module. The image feed will be streamed to Spark framework where the machine learning algorithms like Random Forest and Alternate Least Squares(ALS) has been implemented. Upon building a decision system, there will be a classification that happens on the type of object. This type will be analyzed using the ALS algorithm and a recommendation about the location of the object will be notified to the user via smart phone/ watch.

2.2 Algorithms

The two prominent machine learning algorithms has been used as part of this project.

- Random Forest (Image Classification)

    The objective here is to classify the image based on the object category that it contains. Image classification using random forest has proven to give better results compared to decision trees. Decision tree is encountered with over fitting problem if the dataset is huge. So random forests are trained on various parts of the same training dataset by averaging multiple decision trees. This solves the problem of over fitting that comes with using individual decision trees.

- Alternate Least Squares Collaborative filtering (Recommendation System)

    ALS Collaborative filtering identifies patterns of users to make targeted recommendations. This technique is mainly used in recommendation systems to fill the missing entries in user-item association matrix.

2.3 Data Sets

There are three data sets that we had used as part of this project. They are:

- The first dataset with a listof images of the articles with which weneed to train our robot.(IMAGENETdatabase).

- Secondly, the dataset which specifies the location of the articles that is preferred by the user.

- Third dataset which specifies the list ofusers, whose commands needs to betaken.

2.4 Evaluation:

For classifying images we used Random forests to predict the images, where the training dataset is categorized to 6 categories with each category consisting of about 60 images. The testing dataset is with images that are streamed from android device. With this setup the accuracy noticed is around 75 percent. As the dataset in the training category increases by 20 percent of the current dataset the accuracy decreases gradually.

Similarly in recommendation system, the dataset consists of users information, user ratings and location data where objects could be found. So with ALS collaborative filtering the object is mapped to the possible locations. So the accuracy with technique is around 60 percent.

2.5 Accuracy and Performance:

Using Random forests for image classification the accuracy was around 75 percent. With ALS collaborative filtering in recommendation system the accuracy found is 60 percent.

3 References

Lab Tutorials and the material provided by Dr. Lee.

SPARK - https://spark.apache.org/docs/latest/programming-guide.html#external-datasets

Spark Recommendation - http://spark.apache.org/docs/latest/mllib-collaborative-filtering.html

4 Future Work

To implement a Robo based system that can move around and track the objects. Upon tracking, the user will be notified about the object location. To explore SparkSQL to store the captured images so that we will be able to deal with the massive data. To explore much about the Machine learning algorithms so as to achieve better accuracy in Image Classification. To embed Natural Language Processing techniques into the current working project.

5. Project Management

This project involves the development of Android application with the login page option for users registration and login. A camera module need to be provided on the android application for the user to capture the object images. And the streaming module need to be handled in order to

send these captured images to Spark framework. An Image classification takes place over here on the streaming data. Basically the system will classify the object based on the provided image and will notify the user about the object. Also a smart recommendation system has been developed which takes the classified image as a base input. Using this input data, it recommends the object location to the user. Assuming the user will be carrying the smart android device every single time, we thought that this could be as an innovative thought as the user don't need to spend a lot of time for finding the lost objects.

Name	Task	Contribution	Time Spent	**Grade**
Priyadarsini N	**1. Data Streaming from Android to Spark through Socket communication.** **2. Image Classification with streaming data from Android using Random Forest Algorithm technique.**	**100**	**25**	**100**

Deepthi P	1. **Data Streaming from Android to Spark through Socket communication.** 2. **Recommendation System for finding object location with ALS collaborative filtering technique.**	**100**	**25**	**100**
Tej Kumar Y	1. **Android camera module implementation to capture images.** 2. **Face recognition login.**	**100**	**20**	**100**
Dheeraja V	1. **Android login page** 2. **Notification on android device.**	**100**	**15**	**100**

Final Project Evaluation

Initially we have a plan of implementing a module of ROBOC, where the robot will be roaming around the house and takes the images through its censored IOS device. As there is no Robot functionality involved as part of the resource management, we came up with an idea of implementing an android module where the user needs to capture the images and these images will be streamed to Spark. This adjustment of requirement even in the last stages of the project happens only in Agile Methodology. This Agile methodology basically provides flexibility to the user's requirements and timelines. The usage of the tools liksZenHub, versionOneetc keeps track of the effort of an individual. In the current world, I strongly suggest the developers to provide an option to the client for restructuring the requirements which could be done only through Agile methodology.

There is an equal contribution from each of my team member towards the project and each one is discipline enough while carrying out their tasks.

The Agile methodology could be handled effectively by practicing Scrum system which happens in the real time industries. I suggest to practice these scrum policy (once in a week or so).

5. GitHub Link

https://github.com/SCE-UMKC/BigData-Spring-2016-AssistRobot

6. YouTube Link

https://www.youtube.com/watch?v=HjZGMTrZMIk

7. Presentation Link

https://drive.google.com/file/d/0B6iN7IIkj7l_bVJxZUVjZXlwTDJmZW1CLVRRbGJ5ek9kcndr/view?usp=sharing