# Machine Learning Based Recommendation System for Addiction Recovery

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***Abstract*—Due to growing popularity of mobile phones and technologies, we want everything on our devices. Machine Learning Based Recommendation System for Addiction system is based on the users choice and information. Object detection is also a part of this project which predicts the foods and calorie intake by the users for well-being. This paper proposes a technique to help substance users which are not good for their health by recommendation and object detection. This approach may help with the m-health in the future. Main purpose of this research is to stop the problems that are affecting the business because of drug abuse.**

***Keywords— Machine Learning based Recommendation System, Object Detection, Mobile Application, Recommendation System, Content Filtering, Addiction Recovery,***

## I. INTRODUCTION

Machine Learning based Recommendation System for Addiction Recovery is an idea we came upon whilst discussing the role of addiction, fitness, and proper nutrition on the human mind and body. So, we acknowledged the impact of fitness, nutrition, and mindfulness on brain chemistry and the overall physique of the body. So, our aim is to solve the addiction problems as well as maintain mental and physical well being. Our target audience is basically everyone who want's to help themselves boost their life in every aspect. As I mentioned earlier addiction has made huge loss in business, it can be used my companies who help their staff regain the conciseness and develop performance within them. Our project includes features such as Addiction Recovery using Machine Learning, Maintain diet and nutrition using Machine Learning, Meditate everyday to get points. This will help individuals to recover from addiction and increase the performance.

Thanks to the growing technology that each and everyday new devices are coming to the market with lot's of innovative options. "Mobile Phones" they are small computers that can fit in your hand and pockets. Mobile App is a computer program or software application which are designed and developed to run on Mobile Phones. Currently, mostly active Mobile Phone OS is Android and IOS. Their use has been expanded into using GPS, Gaming, Shopping, Social Networking, Education, etc. This helps us to know how boundless is Mobile Phones with Apps.What we are trying to do is solve the problems that arrises in business and industry. Alcohol and drug abuse by employee causes many expensive loss for both business and industry. According to the National Clearinghouse for Alcohol and Drug Information (NCADI), the loss to the companies due to drug and alcohol abuse by employees totals approx. $100 billion a year in United States [1]. Some of the problems caused in the Workplace are Tardiness, Hangover or withdraw affecting job performance, poor decision making, loss of efficiency, increased likelihood of having trouble with co-workers, etc.

So, the core of the project is to use Machine Learning based recommendation system for Addiction Recovery. We will be using Convolutional Neural Networks (CNN), Deep learning, TenserFlow Framework, Android Studio, Python, Java, Firebase, etc

## II. RECOMMENDATION APPROACH

Recommendation system also known as Recommender platform or Recommendation Engine are a subclass of information filtering system which are intended on predicting the rating or preference a user assign to any particular item. In simple words, it is a technology and technique which recommends particular needs or similar needs according to the user preference. There are two types of filtering approaches for the Recommendation system. It is used to produce a list of recommendations collaborative as well as content-based. Recommendation system has become the trend of today's life with all major business which helps to attract customers.

Recommendation systems or engine can be developed using two approachers they are:

### *A. Collaborative Procedure*

Collaborative Filtering is the process of filtering or evaluating items through the opinions of other people. This technology brings together the opinions of large number of users to a particular. This filtering is best for those business which has large number of users or will be in future. When people give rating for different items the system gets the data analyse it and make predictions. This will recommend the items which are done analysing from large number of users. The typical workflow of the collaborative filtering are:

- User gives rating for item. Ratings are viewed as approximate representative of the users interest in the same platform
- Recommendation system matches ratings with other ratings and find peoples with the similar taste
- With similar users, system will recommend the items which are similar and highly rated by other users that also has similar taste. It also recommends those items which as not given ratings yet by the user

### B. *Content-based Procedure*

Content-based procedure that approach which recommends items based on the description of that item matched against the description of the user profile. In this filtering, recommendation is made based using the features extracted from the content users profiles and items what users have evaluated in the past. Items which has good rating are recommended. The typical workflow of this procedure are:

- Features are extracted from the content of user profile
- Matches the description of the items
- Gives recommendation seeing the highest rating of similar item

## III. RELATED WORK

### A. *AI Calorie Counter*

AI Calorie Counter is a Machine Learning application for android. The main objective of this application is to help facilitate user with their diet. This application usually asks for age, height, current weight, activity level and goal weight and use this information to set a specific amount of daily consumable calories for the user depending on if he/she wants to lose weight, gain weight or maintain the same weight. The user would keep track of these calories by using the application's food recognition software which allows a user to scan a food item that he or she is about to eat and then recognises this food item along with the number of calories of a typical serving size of that food item. These calories would be subtracted from the user's daily consumable calories and the user's remaining calories would be displayed [2].

#### 1. Technologies used in AI Calorie Counter

Technologies used in this application are Machine Learning, A convolutional neural network (CNN), Intel Optimised TenserFlow, Android Camera2, Android Studio, Python, Java. Convolutional Neural Networks (CNN) are trained, constructed and implemented using TenserFlow framework.

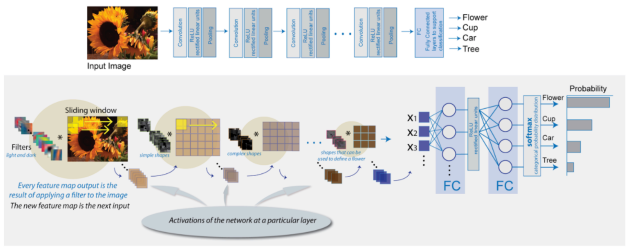


fig 1. A convolutional neural network (CNN) in the Application

**Convolutional layer** can be found in every step as it acts as the core of any CNN. The network of a CNN develops a 2-dimensional activation map that will help in detecting the special position of the feature what are set by parameters [2].

**Pooling layer** acts as a form of down sampling. Max Pooling is the most common implementation of pooling. It is ideal when we are dealing with smaller data sets [2].

**Rectified Linear Units (ReLU) layer** is regarded as a layer of neurones which applies an activation function to increase the nonlinear properties of the decision function as well as overall network without affecting the receptive fields of the convolutional layer[2].

**Fully connected layer** will occur after few convolutional and max pooling layers, does the high level reasoning in the neural network. Neurons will have connections to all the activations amongst the precious layers. The activation for the Fully connected layer are computed by a matrix multiplication and a bias offset [2].

**Loss layer** is used to specify how the network training penalises the deviation between the predicted and true laters. Softmax has been used in this application. So, it is ideal for detecting a single class in a set of mutually exclusive Classes [2].

### B. *I am sober*

I am sober is regarded one of the best app which helps users to ride in the road of recovery. Users consumes different substances which are not quite good for health. So, for the well being of users mentally and physically this app can be used. I am Sober is more than just a sobriety counter app, it helps to keep track of the time and money you've saved by staying sober from alcohol, drugs, and other addictions preventing you from being your best self. This application helps user to recover their addiction in drugs or any other substances.

## IV. PROPOSED SOLUTION

Our proposed solution is by Training the images for detection using TensorFlow Lite. Recording the calories Food Detection and Calorie Logging model that utilises MobileNetV2 SSD architecture in different food classes. Training dataset using Google's teachable machine learning. Creating a dataset which matches the requirement in CSV format, using Jupyter Notebook and python for filtering. Using Logistic Regression for recommendation with Sigmoid Function.

### A. *Logistic Regression*

Logistic regression is one of the most popular Machine learning algorithm that comes under Supervised Learning techniques. It is used to predict the categorical dependent variable with the help of independent variables. The output of Logistic Regression problem can be only between the 0 and 1. Logistic regression can be used where the probabilities between two classes is required. n logistic regression, we pass the weighted sum of inputs through an activation function that can map values in between 0 and 1. Such activation function is known as SIGMOID FUNCTION and the curve obtained is called as sigmoid curve or S- curve.

### B. *Cosine similarity*

Cosine similarity actually computes the normalised L2 dot products from the vector. i.e $x$ and $y$ are row vectors so their cosine similarity $k$ is defines as:

$$k(x, y) = \frac{xy^\top}{\|x\|\|y\|}$$

This is known as cosine similarity as Euclidean (L2) normalisation projects the vectors onto the unit sphere and the dot product is then the cosine of the angle of the points denoted by the vectors. Similarity of documents which are represented as tf-idf vectors can be computed using this kernel and is popular choice for such operation.

### C. *Sigmoid Kernel*

Sigmoid Kernel can also be known as hyperbolic tangent or Multilayer Perceptron because in neural network field it is mostly used to activate neuron function. Sigmoid_Kernel computes the sigmoid kernel between two vectors. For mapping the predicted values to probabilities we use Sigmoid function. It maps the real value between 0 - 1. So, in Machine learning we use sigmoid to map the predicted value to probabilities.

$$S(z) = \frac{1}{1 + e^{-z}}$$

S(z) = probability estimate (value between 0-1)

z = algorithms prediction

E = natural log base

1. So, we have used sigmoid function because it exists in between 0 -1 as well as to predict the probability as an output.

2. First we are giving recommendation according to the drug which user selects and find the similarity in overview column in dataset

3. We unicode the data in overview table using :

```
from sklearn.feature_extraction.text import TfidfVectorizer


tfv = TfidfVectorizer(min_df=3,  max_features=None,
            strip_accents='unicode', analyzer='word',token_pattern=r'\w{1,}',
            ngram_range=(1, 3),
            stop_words = 'english')

# Filling NaNs with empty string
drugs_cleaned_df['overview'] = drugs_cleaned_df['overview'].fillna('')
drugs_cleaned_df['tagline'] = drugs_cleaned_df['tagline'].fillna('')
```

4. Then we use **TF-IDF** which is a statistical measure that evaluates how relevant a word is to a document in a collection of documents :

```
# Fitting the TF-IDF on the 'overview' text
tfv_matrix = tfv.fit_transform(drugs_cleaned_df['overview'])
```

5. After fitting TF-IDF in overview text's we will use SIGMOID Kernel to compute the matrix :

```
from sklearn.metrics.pairwise import sigmoid_kernel

# Compute the sigmoid kernel
sig = sigmoid_kernel(tfv_matrix, tfv_matrix)
```

6. We print the value which has been calculated :

```
sig[0]
```

```
array([0.76159416, 0.76159416, 0.76159416, 0.76159416, 0.76159416,
       0.76159416, 0.76159416, 0.76159416, 0.76159416, 0.76159416,
       0.76159416, 0.76159416, 0.76159416, 0.76159416, 0.76159416,
       0.76159416, 0.76159416, 0.76159416, 0.76159416, 0.76159416,
       0.76159416, 0.76159416, 0.76159416, 0.76159416, 0.76159416,
       0.76159416, 0.76159416, 0.76159416, 0.76159416])
```

## V. SYSTEM DESIGN AND IMPLEMENTATION

### A. *System Architecture*

System Architecture is a conceptual model that defines the structure, behaviour, and more views of a system. It is more like a formal description and representation of a system. Software Architecture is important when developing as it helps users understand the system better and clear which will lead to proper and effective decision making. When assembling a system architecture, this is done during the earliest stages of a project, it exhibits a multitude of ideas and you are able to decide on what you want to work with. The earliest decisions have a huge impact on the flow of the developing processes.

A good software architecture is said to be built when it is strong and easy to maintain, should have domain concepts, flexible, extensible, usable for long term, possibility for adaptation to requirements, high capacity, scalability, easy to refactor, positive responsiveness to change and should not show any decline in performance.

As seen in the diagram below, Our application will be developed using Python and Java as the main coding language which will deal with the frontend development of the application. Mainly used for the designing of the application and creating user interfaces.

We will be using TensorFlow Lite as the framework to associate our application with the recommendation system and object recognition. As we are working with python and java, TensorFlow Lite is a special format model that can be deployed on edge devices such as Android. It is efficient and also a light-weight version where TensorFlow Lite models are able to fit and work on mobile and embedded devices as it occupies less space.

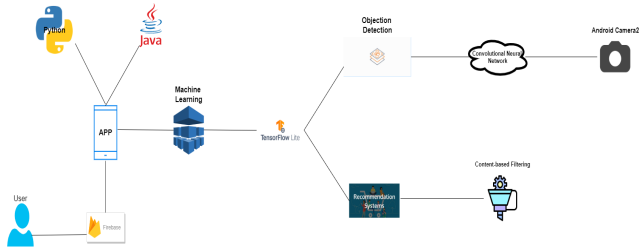


fig 2. System Architecture

Recommendation System is a software of such feature that it exploits user's preferences to provide suggestions to users. This ordinary software helps users to find and even discover new interesting items. The approach we will be adopting for our recommendation system will be Content-based Filtering out of the two that exists.

Content-based filtering is the recommendation system approach that treats recommendation as a user-specific classification problem and acts upon the user's likes and dislikes based on their preferences. So basically how this is achieved is according to users preferences and ratings which will be analysed by the system and will output items based on their data. This will appear in the fitness and meditation features of our application which will output recommendations to users according to their tastes.

Object Detection is a method used to detect presence and location in multiple classes of objects. It helps to recognise images and provides us with a better understanding of an image as a whole. It can be done via multiple ways but we have chosen Deep Learning Object Detection for our project. It will be essential for our project as it will help to identify

objects and give data about the specific item. This will help us in our Calorie Counter feature where it will extract features from the object image and produce an output data of the object.

Convolutional Neural Network is a deep learning algorithm that takes in image and assigns importance to various items in the image where it will help differentiate one object from the other. It is able to successfully capture Spatial and Temporal dependencies of an image through relevant filters which can be trained to understand the sophistication of images as there is a reduction in the number of parameters involved in the reusability of weights

### *B. Implementation*

Well, to develop any application it requires a team. Agile is process of breaking the application or project into several steps. Agile Methodology is regarded as a best practice for software and application development. It helps in collaboration and contribution of each and every person in a team. System Development Life Cycle (SDLC) has different areas such as planning, requirement analysis, design, coding, unit testing, acceptance testing, etc[3]. Agile Manifesto principles is the best part in this methodology i.e. Individuals and interactions, Working Software, Customer Collaboration, Responding to change.

We have chosen Agile Methodology because of following advantages :

- Realistic approach in software development
- Teamwork and cross training are done
- Functions can be developed rapidly and presented
- Suitable for fixed or changing requirements
- Delivers early partial working solutions
- Close, daily cooperation between developers and business people
- Late changes in the requirement are welcomed

The image shows the different iteration in Agile Model:

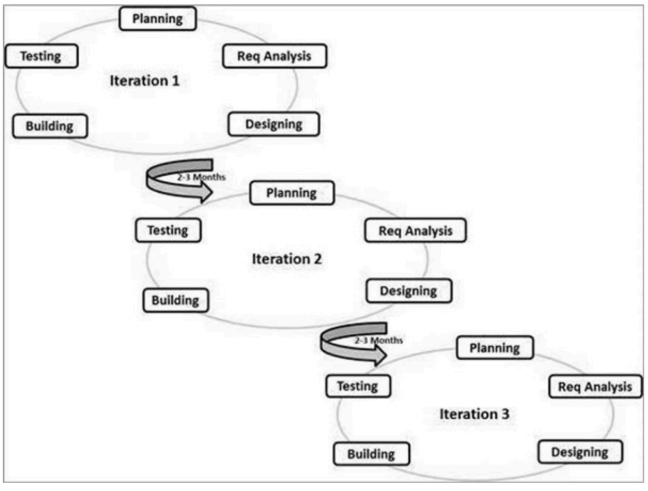


fig 3. Agile Model

There are many frameworks in Agile Methodology such as Scrum, eXtreme Programming(XP), Adaptive Software Development (ASD), Rapid Application Development(RAD), etc. We can use any frameworks according to the requirement. We will be using Scrum because it is beat approach for our project. Scrum is specified by the stages or cycle of development which is known as Sprints. The advantages of choosing Scrum Framework are as follows:

- Motivation in team to meet deadline's of the sprints
- Transparency will help to be followed by all the team and organisation
- This helps to focus on quality of application which results fewer mistakes
- Programmers can reorganise and prioritise the sprints according to the requirement

Scrum is best for the lightweight, team based approach to Agile Development. This fits in our requirement and planning for the application.

## VI. CONCLUSION

Solemn - Addiction Recovery Recommendation System is a non-profit project to provide addiction recovery solutions to users. This in turn could also lead to better economic status by helping with its growth. One of the major factors for this project is to eliminate and ,as much as possibly, reduce the hazardous behaviour that humans tend to get caught up with and destroy their lives which can also help the society improve its state of mind and health. Another major factor for this project is to provide awareness of such potent drugs and its harmfulness to many others through the means of a portable device , which is pretty much owned by almost all humans, and also provide nutritional information to users. We believe and even science has proven that a healthy and refreshing diet helps you stay on track and defeat your cravings with ease.

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