

# **FAKE REVIEW DETECTION FOR HOTELIERS**

**Using Natural Language Processing & Artificial Neural Networks**

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**SmartBridge - Remote Summer Internship Program**

## **1. INTRODUCTION**

There are thousands of reviews online, which makes it convenient for people to make decisions, but the amount of data makes it difficult to sort through. The real value of online reviews is in its content and the certainty that reviewer indeed received products or services prior to writing the review. Promotion or demotion of the products and services is one of the main reasons for deceptive reviews. At times, to create better ratings for the venue, hotel owners pay employees to fabricate false reviews. Alternatively, some reviewers write negative reviews for malicious reasons, like to distort the reputation of the business reviewed.

Individuals use online reviews to make decisions about available products and services. In recent years, businesses and the research community have shown a great amount of interest in the identification of fake online reviews. Applying accurate algorithms to detect fake online reviews can protect individuals from spam and misinformation.

### **Fake Hotel Reviews Consequences:**

All hoteliers know that reviews can make or break a business. More positive reviews earn more reservations and, over time, you can even raise your ADR. It can be tempting to ask friends, family, and employees to leave positive reviews online for your business or even to pay for high marks online. However, aside from being unethical and misleading, fake reviews can have serious consequences for your hotel.

- **Fake Reviews Are Illegal**

Did you know that one car dealership group was fined \$3.6 million by the FTC for reasons including fake reviews? Meanwhile, one business owner in Italy was recently given a nine-month jail sentence for writing hundreds of fake reviews. Soliciting fake reviews is a deceptive practice that interferes with an individual's ability to make a buying decision.

When you think of fake reviews as fraudulent information about your business, they become much less appealing. In addition, if you're considering incentivizing customers for reviews (for example, by providing a discount in exchange for a review), this information must be disclosed in the review. For more details on the FTC's stance on this, you can check out their Endorsements FAQ.



Fig. 1: Yelp Protects Customers From Fake Reviews

TripAdvisor and Yelp are in the business of helping the consumer first, so they'll be on the side of caution in terms of review authenticity. One way that TripAdvisor identifies fake reviews is by tracking IP addresses of reviewers. That means that if your hotel receives multiple reviews from your IP address, they may assume that employees at the property are writing reviews. To prevent being wrongfully flagged as faking reviews, request reviews from guests after their stay – and after they've left your property.

## 1.1 Overview

Individuals use online reviews to make decisions about available products and services. In recent years, businesses and the research community have shown a great amount of interest in the identification of fake online reviews. Applying accurate algorithms to detect fake online reviews can protect individuals from spam and misinformation. We gathered filtered and unfiltered online reviews for several hotels from Kaggle dataset. We extracted part-of-speech features from the data set using Natural Language Processing Techniques, and built an artificial neural network model on the processed data.

## **1.2 Purpose**

Our aim from the project is to make use of natural language processing techniques and build a bag of words model for the detection of fake reviews for hoteliers. Also, we do the hyperparameter tuning to achieve better accuracy. And finally predict whether the review is fake or real and lay out the conclusion.

## **2. LITERATURE SURVEY**

Many studies explore and analyse fake reviews using various techniques for better customer experience. Some of the surveys explore various data mining techniques for their detection accuracy, including logistic regression, multilayer perception, ANN, decision table, radical basic function, naive Bayes, k-nearest neighbour, and sequential minimal optimization. Depending on the type of dataset, such techniques show differences in the level of accuracy, and there is no single rule for the best result.

The research we have done suggests that machine learning provides important insights into data and can help classify data into different classes. The findings indicate that natural language processing techniques can produce accurate classification results if used in conjunction with feature selection techniques. Therefore, retaining the benefits of classification results for machine learning techniques, this study employs a set of the most popular natural language processing techniques in combination with feature selection technique to classify fake and real reviews.

### **2.1 Existing problem**

Nowadays the fake online reviews became threat for all kind of businesses, in last year 82% of consumers have read a fake review online. The sheer volume of fake reviews being observed is obviously a cause for concern. It highlights how prevalent fake reviews now are, underscoring the importance both of being vigilant and of knowing how to get them removed.

The extent to which fake reviews have infiltrated this area of reputation management threatens the trustworthiness of reviews as a whole – should consumers be exposed to an increasing number of fake reviews, it's perfectly feasible that we'll soon begin to see confidence in peer-to-peer recommendations being eroded.

A second worry is that this statistic suggests future generations are already being programmed to be wary of online reviews. If that's the case, you'll need to find new means of establishing trust with future customers.

## **2.2 Proposed Solution**

Data mining is the process of analysing data from different perspectives and extracting useful knowledge from it. It is the core of knowledge discovery process. The various steps involved in extracting knowledge from raw data.

Different data mining techniques include classification, clustering, association rule mining, prediction and sequential patterns, neural networks, regression etc. Classification is the most commonly applied data mining technique, which employs a set of pre-classified examples to develop a model that can classify the population of records at large. Fraud detection and credit risk applications are particularly well suited to classification technique.

This approach frequently employs Artificial Neural Networks. Here, a training set along with Natural Language Processing Techniques are used to build the ANN model as the classifier which can classify the fake and real reviews in appropriate classes. A test set is used to validate the model.

## **3. THEORETICAL ANALYSIS**

While selecting the algorithm that gives an accurate prediction we gone through lot of algorithms which gives the results abruptly accurate and from them we selected only one algorithm for the prediction problem that is Deep Neural Networks(Artificial Neural Networks), it assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature. That's how the prediction work great with the Deep Neural Networks.

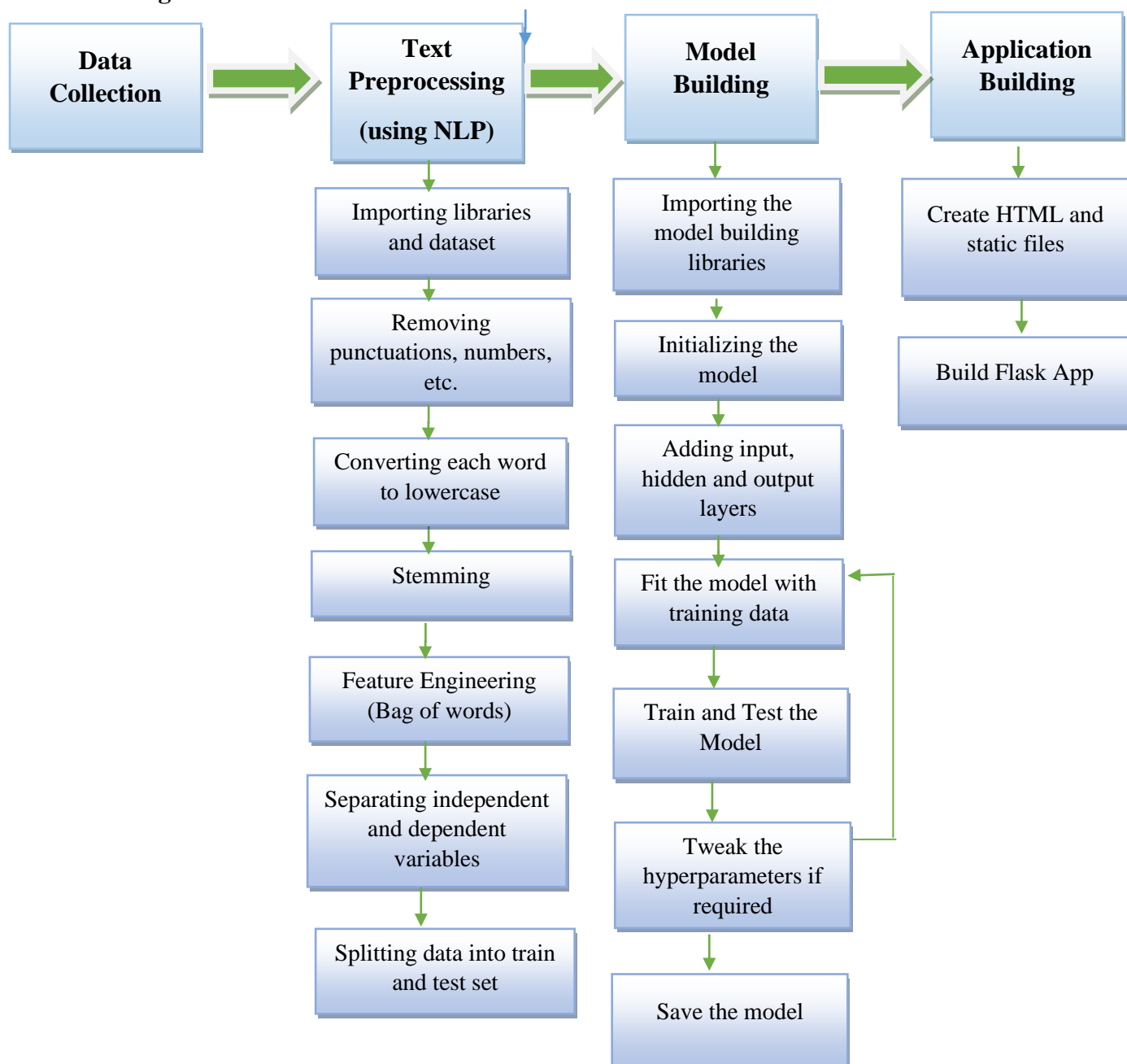
Accuracy is defined as the ratio of the number of samples correctly classified by the classifier to the total number of samples for a given test data set. At first we got like lot of worst accuracies because we tried lot of algorithms for the best accurate algorithm , finally after all of that we tried the best suitable technique which gives the prediction accurately is Deep Neural Networks. And developed it to use as a real time prediction problem for the fake review detection system.

### 3.1 Software Designing

- Spyder
- Machine Learning & Deep Learning Techniques
- Python
- HTML5, CSS3, Bootstrap
- Flask

We developed this fake review detection system by using the Python language, which is a high level programming language along with Machine Learning (NLP) and Deep Learning (Deep Neural Networks). For coding we used the Spyder, an integrated development environment for python language. Flask is used as a user interface for the prediction. Hypertext Markup Language (HTML) is the standard markup language for documents designed to be displayed in a web browser.

### 3.2 Block Diagram



## 4. Experimental Investigation

In our project, we have used the deception opinion dataset. The data that is used in this project originally comes from the kaggle machine learning dataset . The data consists of over 1600 records from different hotels with truthful and deceptive reviews.

## 5. DATASET DESCRIPTION

We use the following representation to collect the dataset

deceptive – whether review is deceptive or truthful

hotel – name of the hotel

polarity – whether review is positive or negative (sentiments)

source – website from which review was taken

text – review written by customer

### Attribute Information:

We use feature engineering (bag of words model) to extract 2000 features from the reviews written by customer.

	A	B	C	D	E
1	deceptive	hotel	polarity	source	text
2	truthful	conrad	positive	TripAdvis	We
3	truthful	hyatt	positive	TripAdvis	Triple A
4	truthful	hyatt	positive	TripAdvis	This
5	truthful	omni	positive	TripAdvis	The
6	truthful	hyatt	positive	TripAdvis	I asked
7	truthful	omni	positive	TripAdvis	I stayed
8	truthful	conrad	positive	TripAdvis	We
9	truthful	omni	positive	TripAdvis	Just got
10	truthful	omni	positive	TripAdvis	We
11	truthful	hyatt	positive	TripAdvis	On our
12	truthful	fairmont	positive	TripAdvis	I stayed
13	truthful	conrad	positive	TripAdvis	Ok, so
14	truthful	hyatt	positive	TripAdvis	We
15	truthful	conrad	positive	TripAdvis	My wife
16	truthful	hyatt	positive	TripAdvis	I got a
17	truthful	conrad	positive	TripAdvis	This is a
18	truthful	conrad	positive	TripAdvis	We
19	truthful	conrad	positive	TripAdvis	The
20	truthful	conrad	positive	TripAdvis	My
21	truthful	omni	positive	TripAdvis	Got a
22	truthful	fairmont	positive	TripAdvis	I stayed
23	truthful	fairmont	positive	TripAdvis	We went
24	truthful	fairmont	positive	TripAdvis	I actually
25	truthful	hyatt	positive	TripAdvis	Named
26	truthful	hyatt	positive	TripAdvis	Check-
27	truthful	conrad	positive	TripAdvis	Arrived
28	truthful	fairmont	positive	TripAdvis	Simply a

We stayed for a one night getaway with family on a thursday. Triple AAA rate of 173 was a steal. 7th floor room complete with 44in plasma TV bose stereo, voss and evian water, and gorgeous bathroom(no tub but was fine for us) Concierge was very helpful. You cannot beat this location... Only flaw was breakfast was pricey and service was very very slow(2hours for four kids and four adults on a friday morning) even though there were only two other tables in the restaurant. Food was very good so it was worth the wait. I would return in a heartbeat. A gem in chicago...

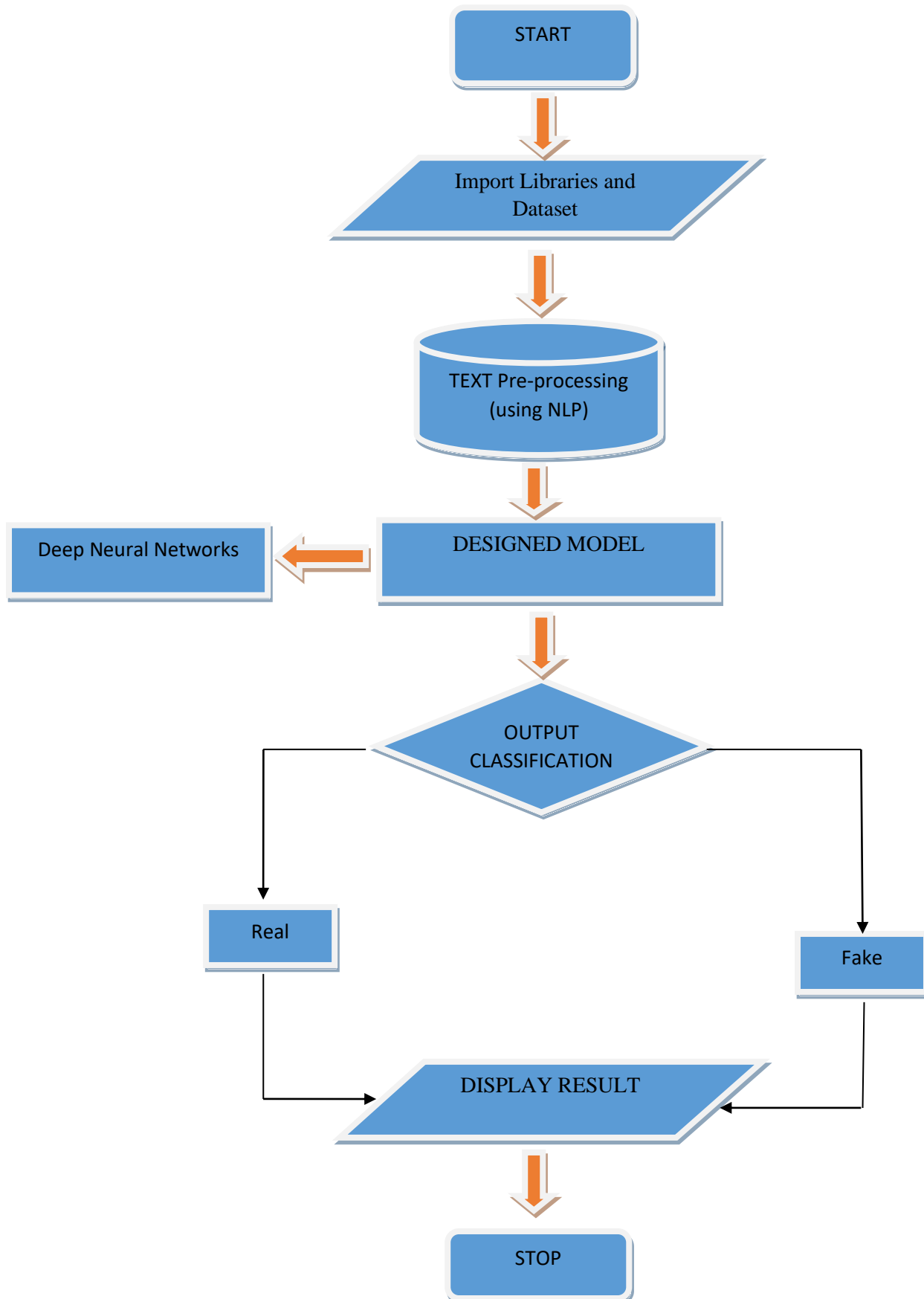
If you're looking for an elegant hotel in downtown Chicago, you have to stay here. The Ambassador East Hotel has very comfortable and beautiful large rooms and is like a home away from home. The perfect place for a business person, and if you have a small pet you can bring them too! I would give this place four stars and would definitely stay here again.

The heating in our room didn't work and wasn't repaired despite numerous requests, the rooms were very small, the litter in the bin remained in the bin for the whole stay, the cleaner made the bed but nothing else, when we returned home my credit card statement showed that the hotel had charged me for the 5 night stay despite my having pre-paid through a travel agent, it took the hotel 2 months to re-credit my card without an apology or offer to pay for my numerous trans-Atlantic phone calls to them.

The staff at the James Chicago hotel seemed determined to make my stay a horrible one. When I entered the establishment to check in, I was ignored. The clerk let half a dozen people in front of me before she even acknowledged me. Thinking room service would be better, I relaxed in my room while I waited for my food. By the time it reached my room, it was cold AND the wrong order. Disgusted, I went down to the pool only to find it was closed for maintenance. All the restaurants the hotel recommended were one-star, and none of my regular channels were on the tv. All in all, it was a bad stay at the James hotel in Chicago.

Fig. 2: Dataset along with few sample reviews from it

## 5.FLOWCHART:



## 6.RESULT

Here, Deep Neural Network predicts the whether review is truthful or deceptive. It results 1 or 0 as output. Natural Language Processing is used to pre-process the text and feature engineering (feature extraction) is used to build Bag of Words model.

Key	Type	Size	Value												
aaa	int32	1	0												
abil	int32	1	1												
abl	int32	1	2												
absolut	int32	1	3												
ac	int32	1	4												
accept	int32	1	5												
access	int32	1	6												
accommod	int32	1	7												
accomod	int32	1	8												
account	int32	1	9												
accur	int32	1	10												
acknowledg	int32	1	11												
across	int32	1	12												
act	int32	1	13												
action	int32	1	14												
activ	int32	1	15												
actual	int32	1	16												
ad	int32	1	17												
add	int32	1	18												
addit	int32	1	19												

	0	1	2	3	4	5	6	7	8	9	10	11	12
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	1	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	1	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	1	0	0	0	1	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 3: Bag of Words



In this project, the Deep Neural Networks are used and hence its performance. The results show 98.5% accuracy.

```
accuracy: 0.9852
```

Fig. 4: Accuracy

## Snapshots:

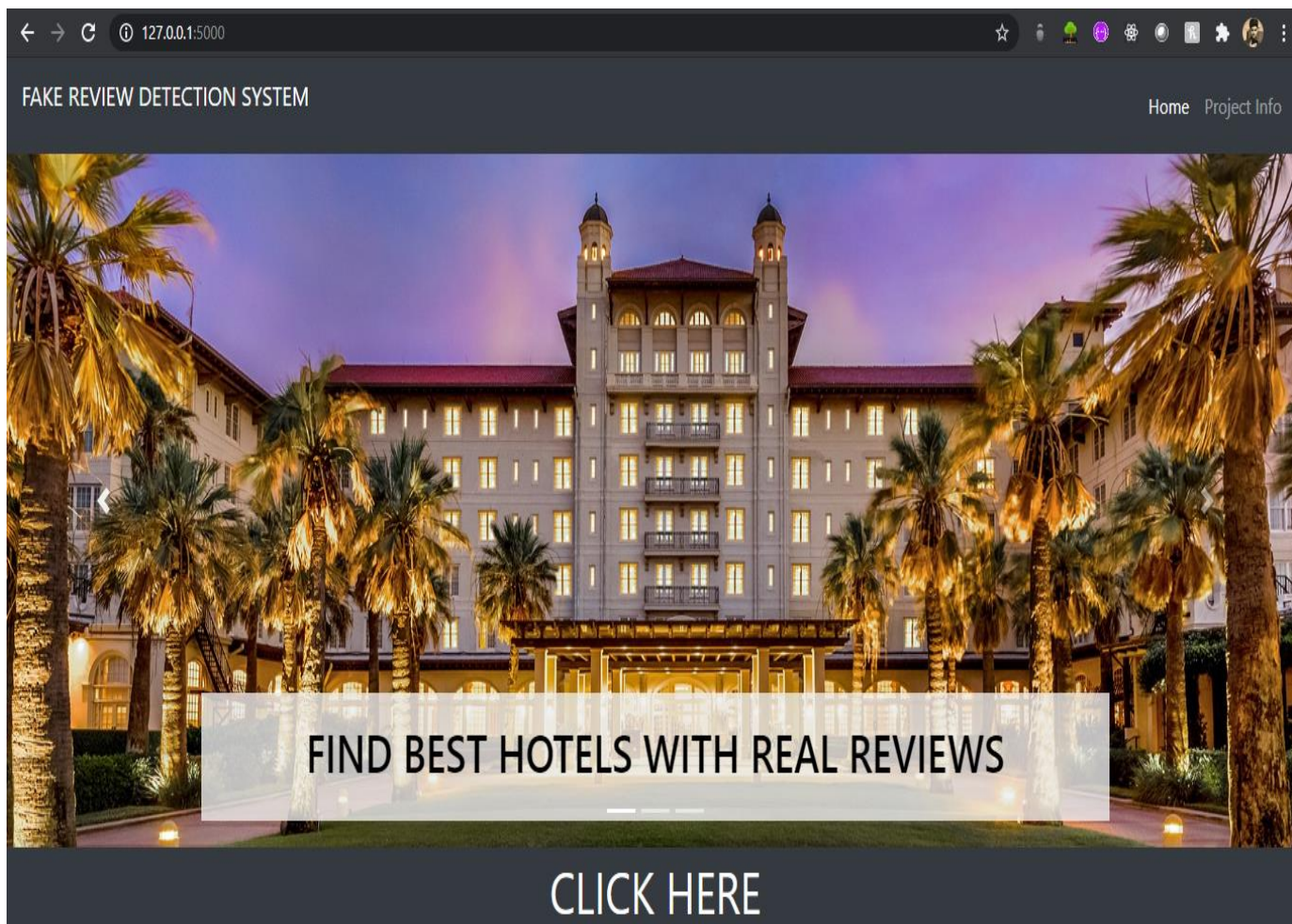


Fig:5 - Home Page

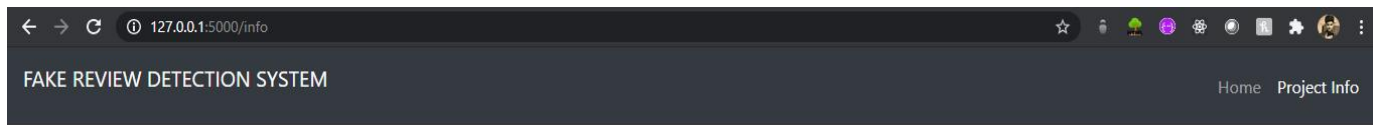


Fig 6: Project Info Page

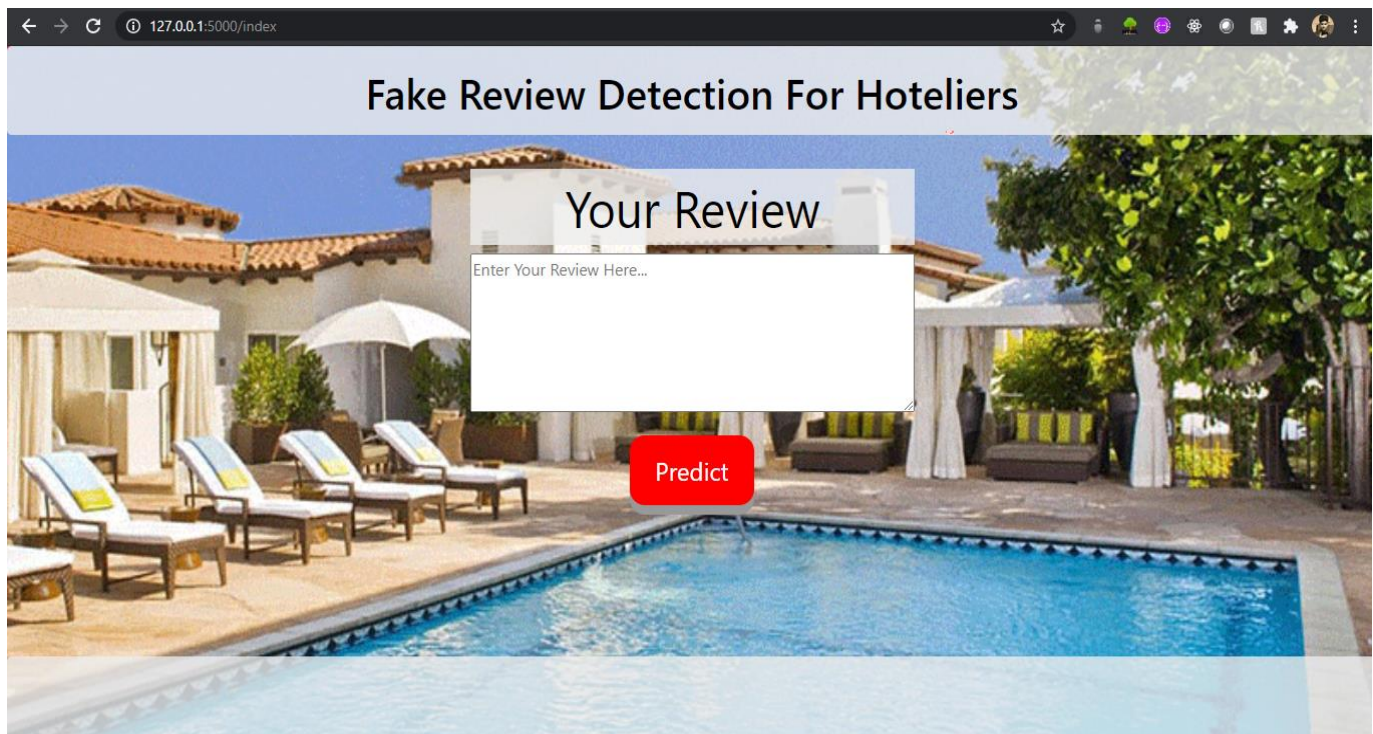


Fig:7 - When you click on CLICK HERE in Fig:6 or Fig:5, it will redirect to Index Page.



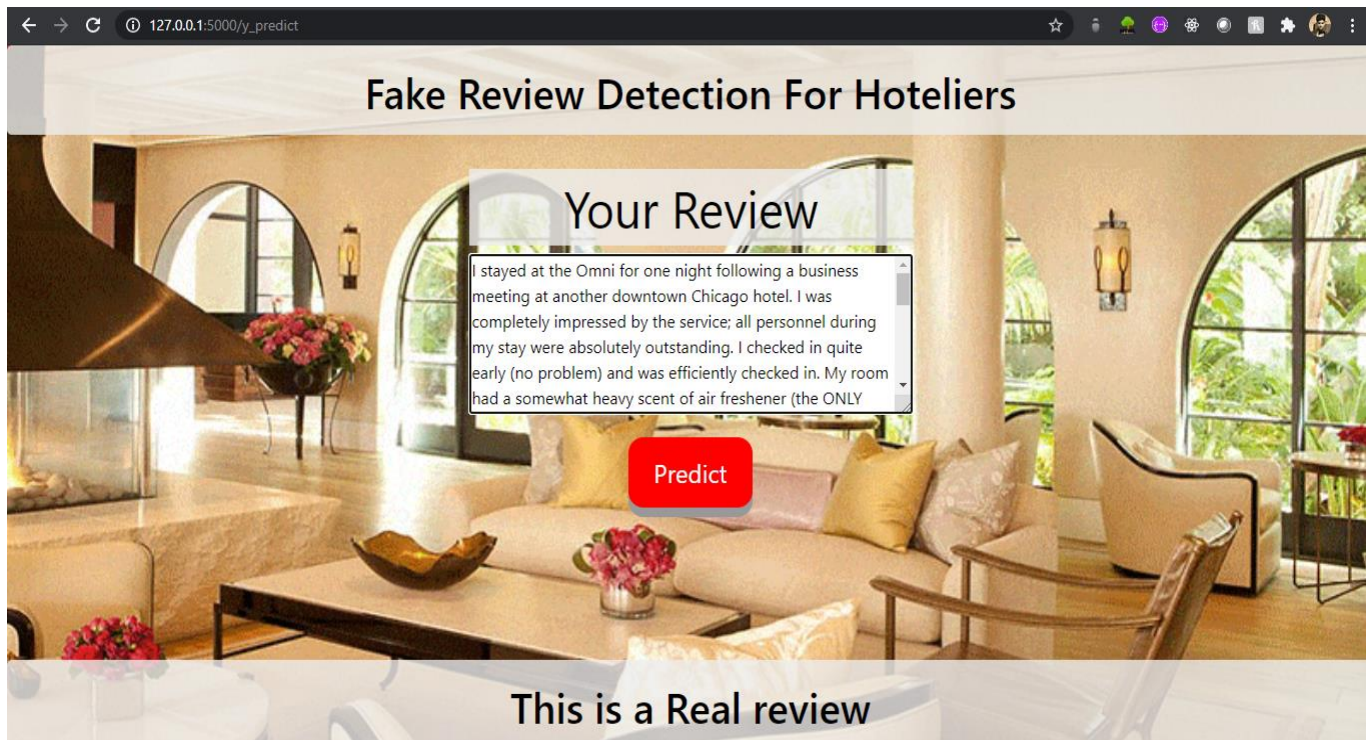


Fig:8 - Positive Classification Example : indicates that the review is Real.

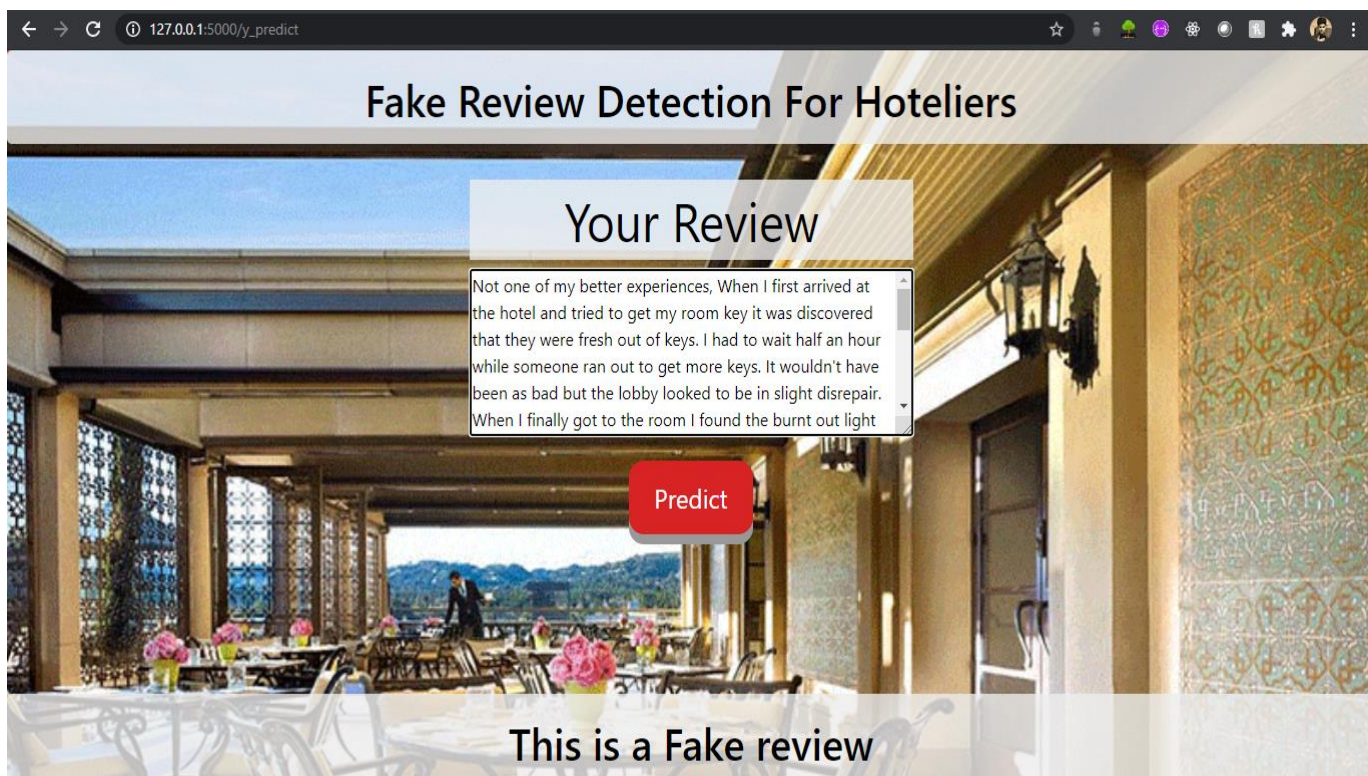


Fig:9 - Negative Classification Example : indicates that the review is Fake.

## **7. ADVANTAGES AND DISADVANTAGES**

### **Advantages:**

1. Bag of Words is easy to implement and understand.
2. It operates in real-time due to low time complexity.
3. It is applicable in training and test-time.
4. This model is very intuitive and easy to explain to technical teams as well as to stakeholders.

### **Disadvantages:**

1. Bag of words doesn't leverage co-occurrence statistics between words. In other words, it assumes all words are independent of each other.
2. It leads to a highly sparse vectors as there is nonzero value in dimensions corresponding to words that occur in the sentence.

## **8. APPLICATIONS:**

1. "Fake Review Detection System using Natural Language Processing" simplifies the management process of detecting deceptive reviews by deploying a web interface to the users.
2. Fast processing and immediate results with high accuracy.
3. Minimizing human effort and cost efficient databases.
4. Navigation through the site is easy.

## **9. CONCLUSION:**

This project consists of the details about the model which is used for the fake review detection for hoteliers. From the results, it is proven that the accuracy of the model has reached good level, if it is deployed in the real-time scenario then it will help many people in booking hotels without wasting the money on poor quality hotels. If the review is confirmed as fake by the model, then the person can avoid getting fooled and have a good travelling experience. It can be the best way of practice for people to save money and time for searching best hotels. As we know that the data plays a crucial role in every machine learning model, if the data is more specific and accurate about the truthfulness of the hotel review then that can help in reaching greater accuracy with better results in real-time applications.

## **10. FUTURE SCOPE:**

In this project, we collected data, extracted part-of-speech features, and applied Natural Language Processing (Bag of Words) to identify fake online reviews. We found that highest accuracy was achieved by applying the Deep Neural Network classification model to our dataset.

In our future work, we plan to improve on our methods for extracting features from datasets. We also intend to use more classification models, develop better system, and introduce a reliability score for fake reviews.

## **11. BIBLIOGRAPHY**

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## APPENDIX

### HTML FILE:

```
<!doctype html>

<html lang="en">

<head>

  <!-- Required meta tags -->

  <meta charset="utf-8">

  <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">


  <!-- Bootstrap CSS -->

  <link                                                    rel="stylesheet"
href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css"
integrity="sha384-
JcKb8q3iqJ61gNV9KGb8thSsNjpSL0n8PARn9HuZOnIxN0hoP+VmmDGMN5t9UJ0Z"
crossorigin="anonymous">

  <link rel="stylesheet" href="{{ url_for('static', filename='css/style.css') }}">

<style>

  body{

    background-image: url("{{ url_for('static', filename='img/bg2.gif') }}");
```

```

        background-repeat: no-repeat;

        background-size: cover;

    }
</style>

<title>ML API</title>

</head>

<body>

    <h1 class="jumbotron" style="text-align: center;">Fake Review Detection For
    Hoteliers</h1>

    <div class="container">

        <form action="{{ url_for('y_predict') }}" method="post">

            <div class="form-group col-auto">

                <label>Your Review</label>

                <textarea autofocus=autofocus rows="6" cols="60" name="review"
                placeholder="Enter Your Review Here..." required="required"></textarea>

            </div>

            <button type="submit">Predict</button>

        </form>

        <br>

        <br>

    </div>

    <h1 class="jumbotron predict-text" style="text-align: center;">{{ prediction_text }}</h1>

</body>

</html>

```

### **app.py file:**

```

# -*- coding: utf-8 -*-

from flask import Flask, request, render_template

from sklearn.feature_extraction.text import CountVectorizer

```

```

from joblib import load
app = Flask(__name__)
from tensorflow import keras
model = keras.models.load_model('model1.h5')

@app.route('/')
def home():
    return render_template('homepage.html')

@app.route('/info')
def info():
    return render_template('info.html')

@app.route('/index')
def index():
    return render_template('index.html')

@app.route('/y_predict',methods=['POST'])
def y_predict():
    """
    For rendering results on HTML GUI
    """
    da = [[x for x in request.form.values()]]
    da = da[0][0]
    print(da)

    loaded=CountVectorizer(decode_error='replace',vocabulary=load('features.save'))

    da=da.split('delimiter')
    result=model.predict(loaded.transform(da))

```



```
print(result)
```

```
if result >= 0.5:
```

```
    output = "Real"
```

```
else:
```

```
    output = "Fake"
```

```
return render_template('index.html', prediction_text='This is a { } review'.format(output))
```

```
if __name__ == "__main__":
```

```
    app.run(debug=True)
```