Project Report

IDS 594: Machine Learning Deployment

Estimating Prices of Used Cars

Project by:

Aditya Gajula (660252623)

Niharika Yogesh Apte (676583822)

Krishangi Deka (664357494)

Dhruv Dhami (665626746)

Mehul Sharma (668967914)

Professor Theja Tulabandhula

Date: October 14, 2020

Important Links for submission:

GitHub Repository: https://github.com/krishangi-deka/carprice

YouTube Video Presentation: https://www.youtube.com/watch?v=8anY4NGTcBA&feature=youtu.be

Webpage Link: http://ec2-54-163-16-187.compute-1.amazonaws.com:8501/

ABSTRACT

The purpose of this project is to show how to instantiate and execute a project using the AWS EC2 structure and Streamlit templates and to deploy a machine learning model which is used to estimate the prices of used cars.

1. INTRODUCTION

This system provides users with a website that easily predicts the used car prices. Different python packages have been used to develop the ML model. Most importantly, we have used Amazon Elastic Compute Cloud (Amazon EC2) as the web service through which we have deployed the ML model. We have used Streamlit as our app framework. We will be explaining our choice further in this report. This report aims to provide a detailed look at our project progress and the resulting project including the packages, code and the analysis we applied on it.

1.1. Background

We started this project trying to apply the knowledge acquired in the course- Machine Learning Deployment (Fall 2020). Our project covers most of the concepts that we learnt in this course such as the deployment of a Machine Learning model along with exploring and choosing the best service to deploy the model. We previously planned to work with Lambda function but after thorough research found out that the runtime for lambda function is just 900 seconds after which you will have to re-run the app which is not the case with EC2. Also, Lambda functions do not save the state which EC2 provides. Hence, we chose to proceed with EC2.

The disadvantage of using EC2 is that they require security updates and patches which are not required in lambda functions.

1.2. Project Brief

The main goal of this project is to deploy a Web app that estimates used car prices based on the inputs provided. The project provides an easy user interface for the users to select their inputs by specifying the numeric values and the estimated price of the used car is displayed for the specifications given. The continuous variables that we have considered to determine the car prices are max mileage covered by the car, city mileage, highways MPG and car type and model year are our discrete variables.

1.3. Objectives of the project

- To estimate the prices of used cars so that users can determine how much their used car would be sold for.
- Deploy the machine learning model through a cost-free web service.
- Making the system responsive and user-friendly.

1.4. Workflow

- Build model
- Host within a source code repository system(GitHub)
- Build/create an EC2 instance
- Add custom TCP ports
- Generate private key-pair (.pem file)
- Connect to instance using Putty (.ppk file)
- Connect to Linux instance: Configure the host settings and authorize instance
- Run Linux instance on cloud (Should run automatically)
- Install python and all libraries and dependencies
- Transfer python script and all data files to EC2 Linux instance.
- Run the app hosted on Streamlit.

1.5. Scope of the project

The project is helpful to model the price of used cars with the available independent variables. It will be used by the individuals to understand how exactly the prices vary with the independent variables.

Model Specifications:

Linear regression is an algorithm that uses variables (or features for machine learning) to predict a quantitative variable (the target variable). More specifically it tries to fit a straight line through the data that best represents the relationship between the predictor variables and the target variable. Linear regression model was used to calculate the coefficients and the value of Target variable (‘your car is worth approximately’) is obtained from the predictor variables.

The model involved choosing the right set of predictor variables which are significant and can be used to estimate the approximate price of a used car. How well these variables describe the price of a used car, based on various market surveys, Max mileage (Miles travelled), City MPG, Highway MPG, Model year (year car was launched), were used as the output determining features.

As developers we must make sure that:

- We have all the necessary information related to the car prices(data)
- Make use of a web framework which could help us deploy the app in a more systematic way.

- Maintain the color scheme and style for the web app to make it look appealing, make it as user-friendly as possible.

Implementation and maintenance

This is extremely important, since our web app has chances to break down. Making sure that our web app has less probability of being unavailable due to technical reasons.

Scope Planning

Our system included planning, design, development and testing. We made sure that we will meet or exceed the software standards and also any additional requirements established by clients.

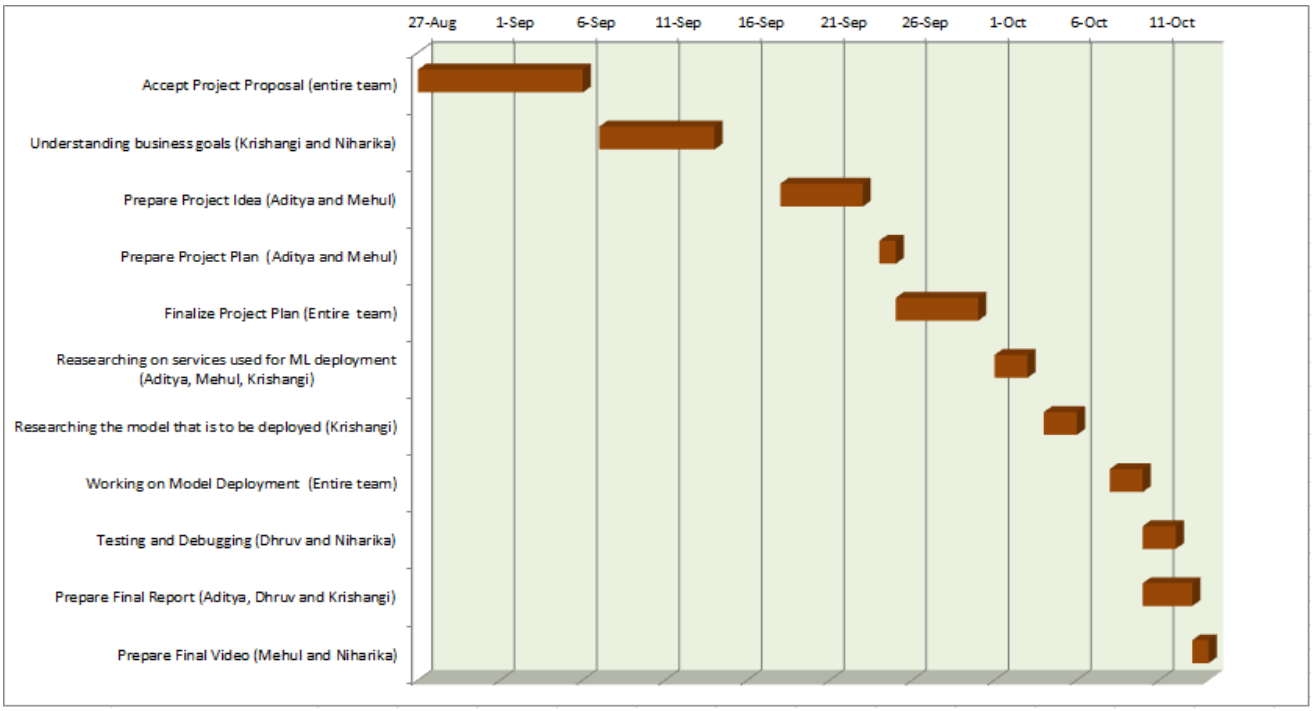
Creating the System

We first planned and finalized the service which we would be using to deploy the model. We then decided the topic and the business problem that we would be solving for this project. We researched about various topics and decided to go with estimating car prices for used cars. The web app framework to be used to deploy this model was then selected. We were initially confused between Flask and Streamlit, but decided to go ahead with Streamlit as we wanted to explore this framework and also wanted a simpler and less complicated front end. The main task was learning how to deploy this framework and the model on EC2. After completing the deployment, we tested the system and improved on the front end layout to make it more aesthetic.

Scope Verification

We distributed responsibilities amongst the members of our team on the basis of researching on EC2 deployment, writing the Streamlit code for deployment, testing and documentation. We distributed tasks in such a way that every member could contribute to the main task, which was the ML deployment on EC2. We made sure that each member stuck to deadlines and we followed up with each other through online zoom meetings. In this way we could make sure that the work is equally distributed and each of us had an opportunity to learn and explore.

Gantt Chart for task distribution



2. REQUIREMENT SPECIFICATIONS

Hardware:

- Monitor/ Desktop

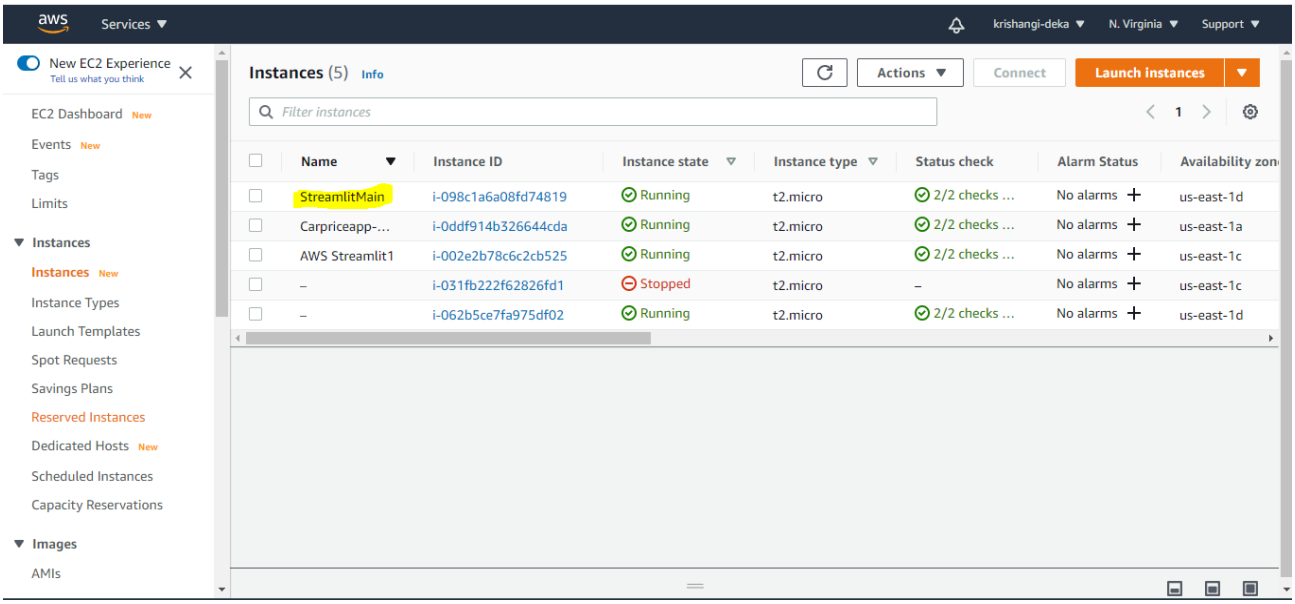
Software:

- Web service : AWS EC2 (Deep Learning AMI (Ubuntu 16.04) Version 35.0)
- Operating System : Windows 10/Linux
- Programming Language : Python
- Web App Framework: Streamlit
- Other soft wares: Putty and Puttygen (for SSH)

3. SCREENSHOTS

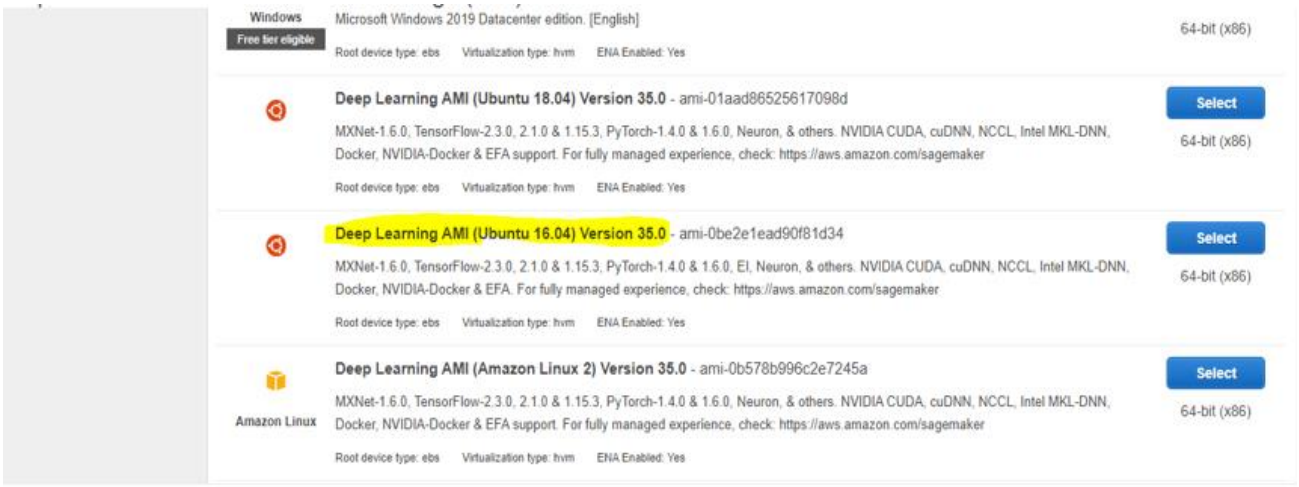
AWS EC2 setup:

Step 1. Create Instance

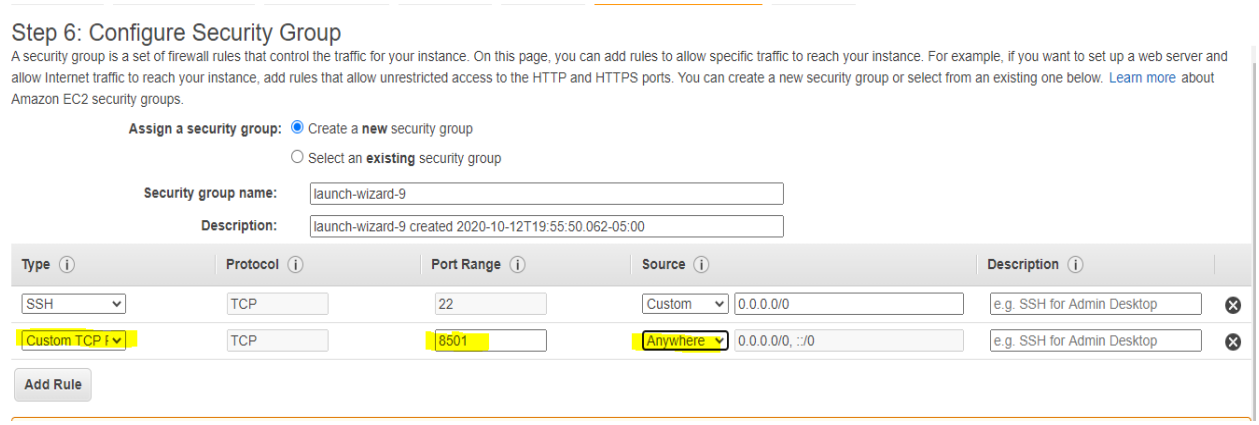


Step 2. Choose an Amazon Machine Image

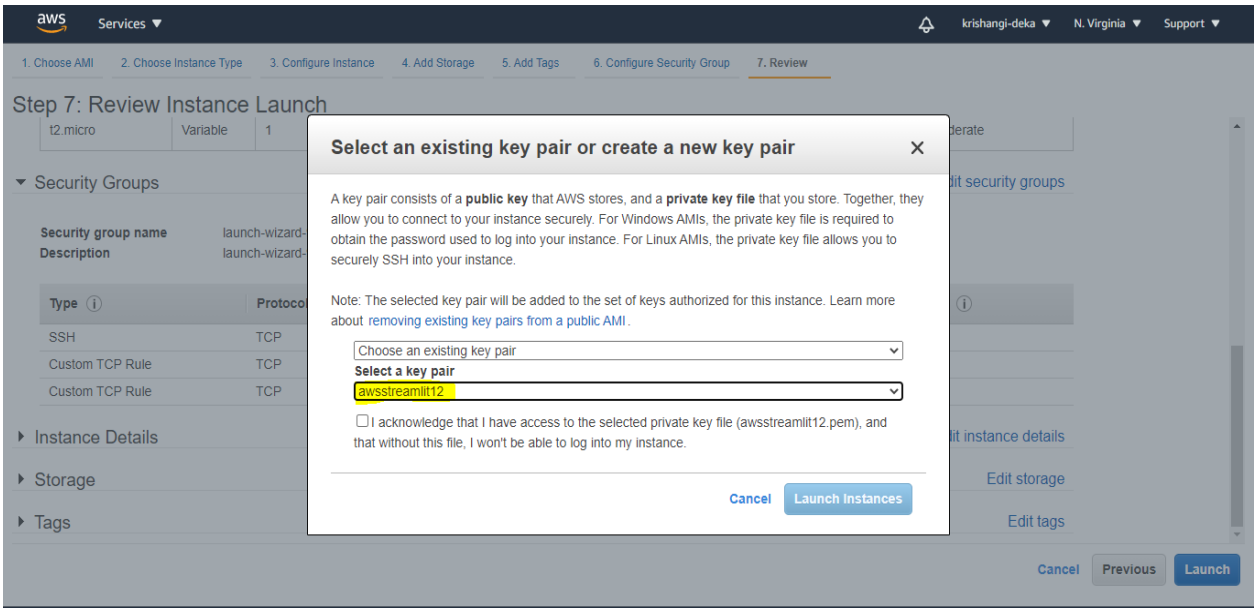
Here we have chosen the Deep learning AMI (free tier version)



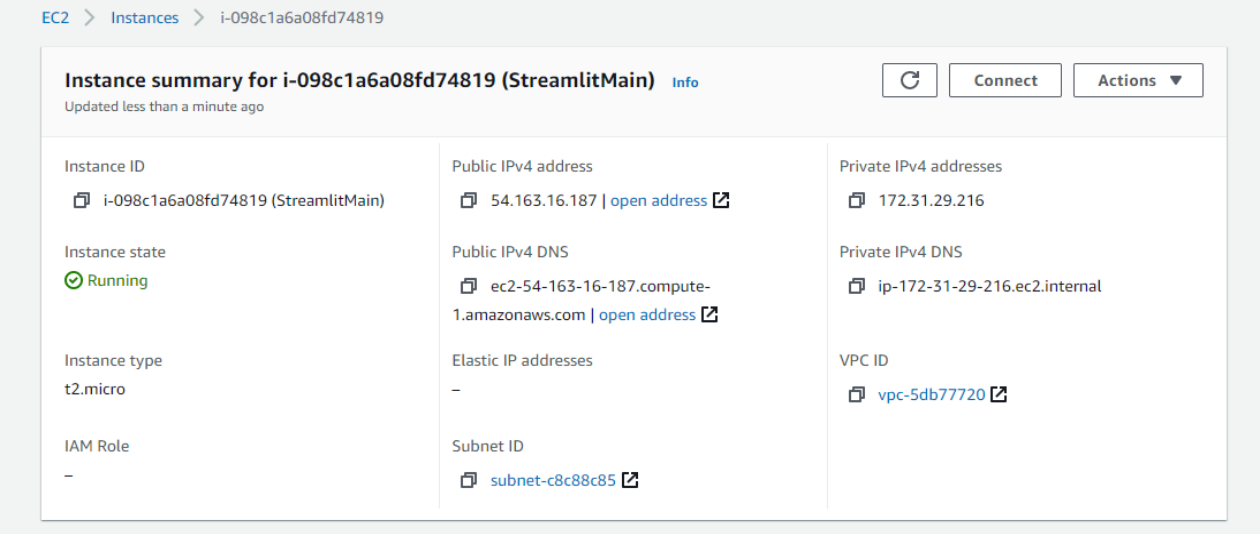
Step 3. Configure Security Group



Step 4. Download pem key pair file

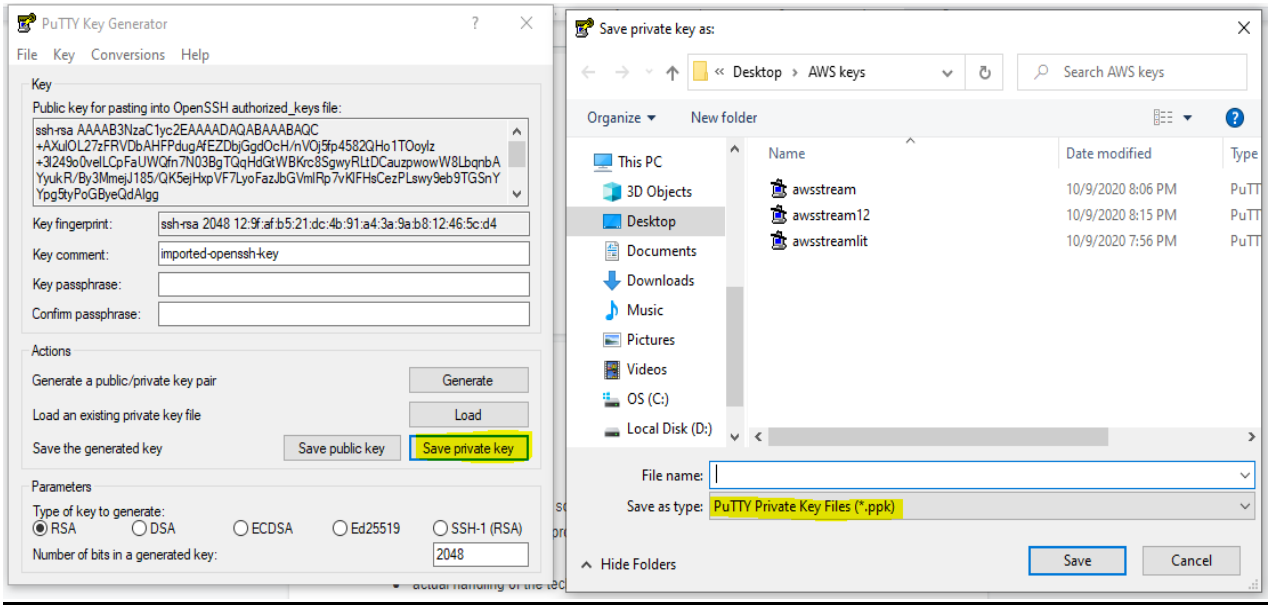


Step 5. Note the DNS address and make sure the instance is running.

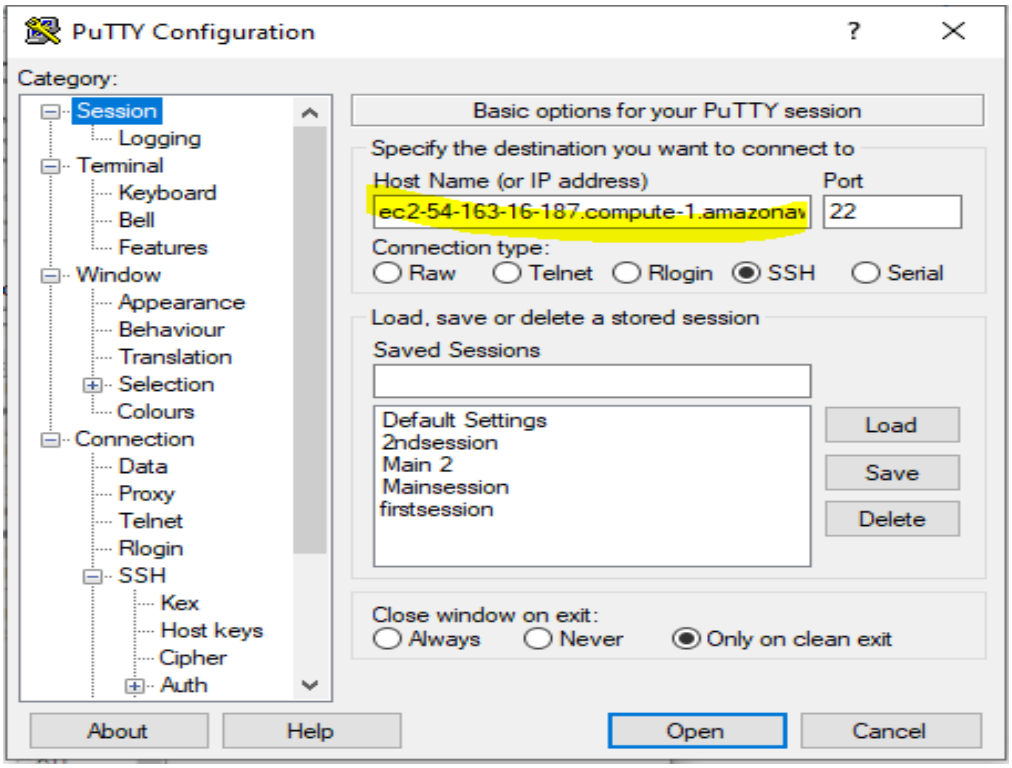


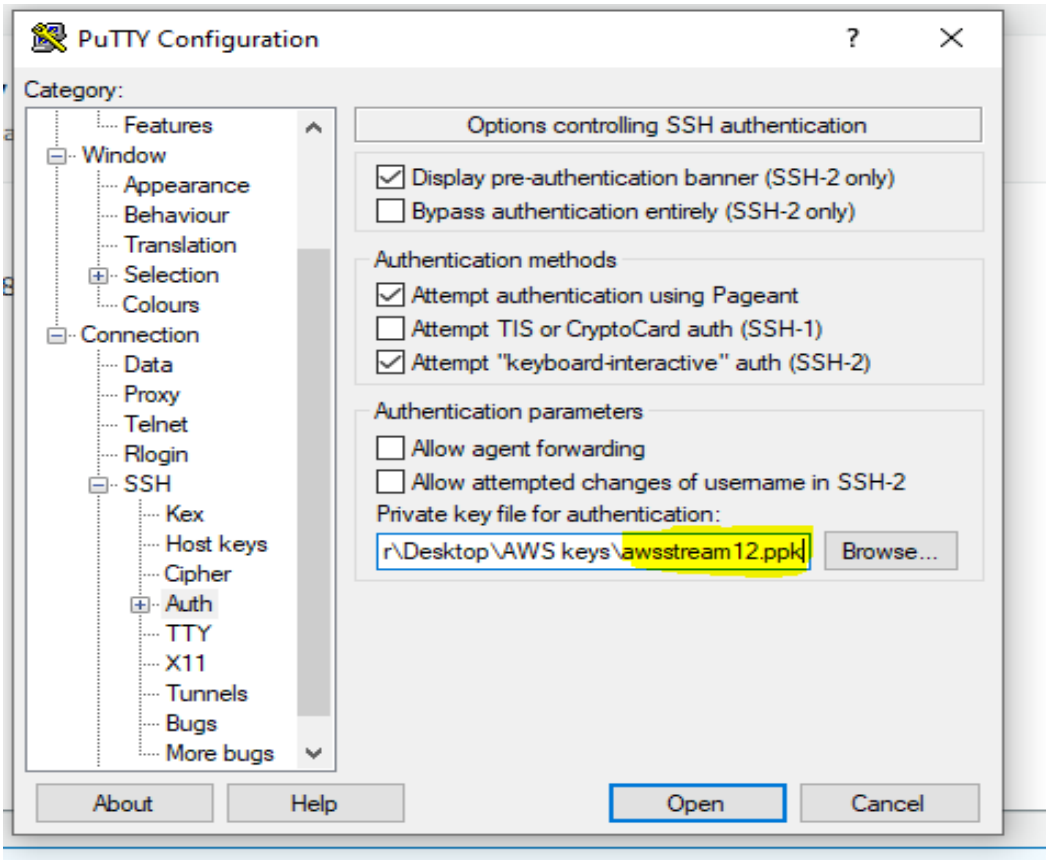
PUTTYGEN and PUTTY setup (for connecting AWS instance):

Step 1. Save the .pem file as .ppk file through Puttygen.

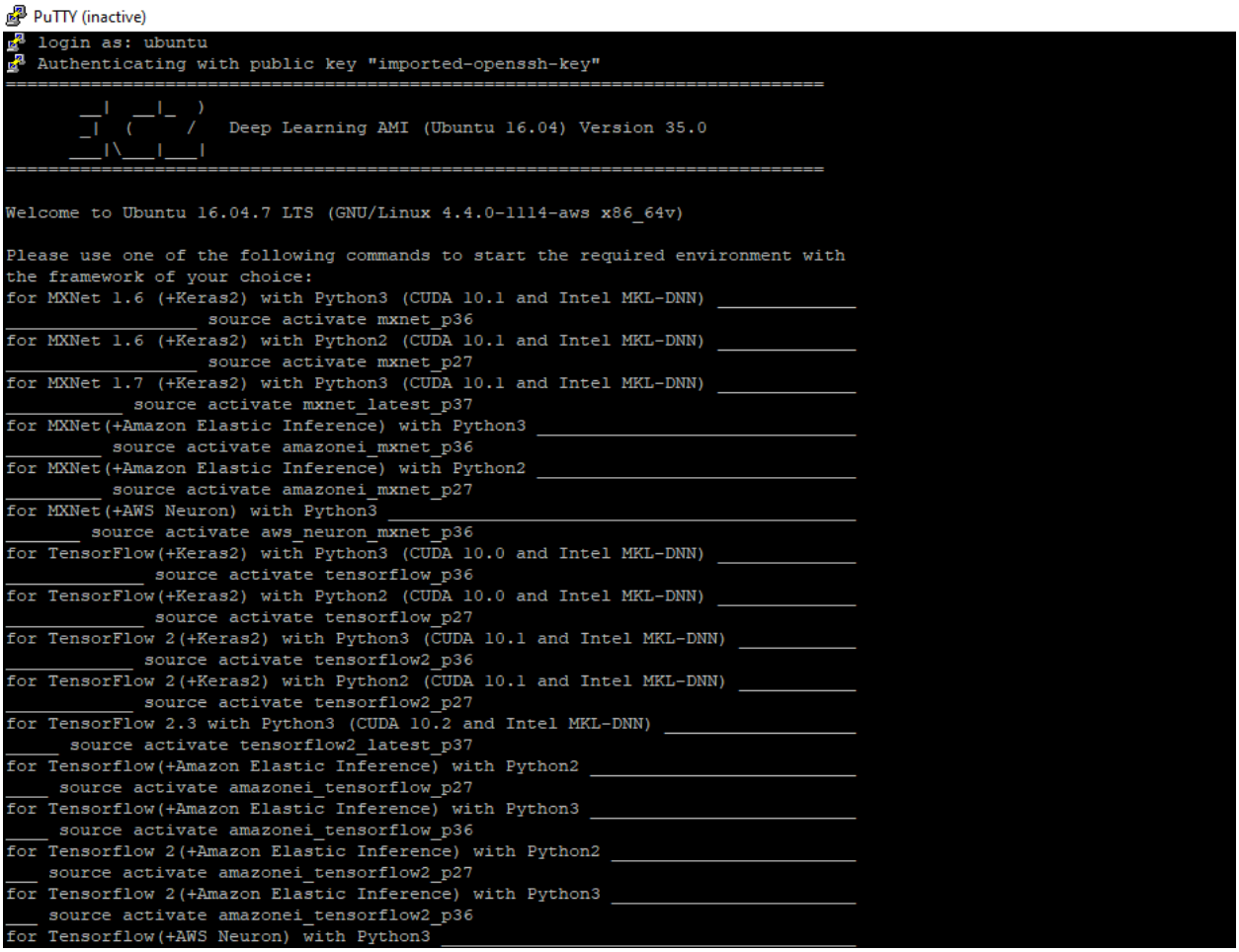


Step 2. Load the DNS address in the host name and the key in Putty.

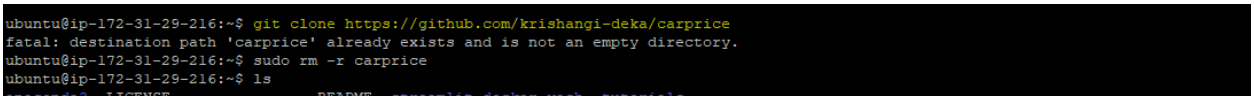


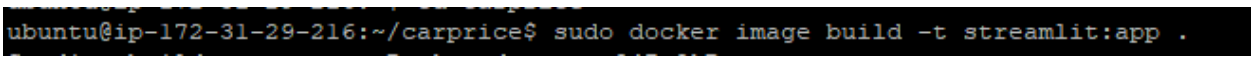


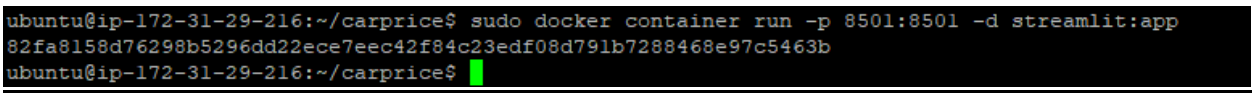
Step 3. Launch the Putty session and enter login details



Enter commands to deploy the model through Streamlit.







4. LESSONS LEARNED

- Streamlit is not always an easy framework to deploy through AWS EC2 as it is a separate module which requires installation and configuration which we couldn't easily install on the virtual server and faced many issues and bugs due to this.

- We chose to systematically run all the commands through a Docker file which could easily install all modules needed for the deployment which solved most of the issues.

5. CONCLUSION

Elastic Cloud Compute is an easy to use service that lets you create and delete virtual machines in the cloud easily. We basically ran our Streamlit web app on an EC2 instance and created a web page which could solve our business solution in an easy and aesthetic way. Hence through this project we learnt that creating web apps is an easy task, but for the world to see your web app you need a web service. Without these web services, creating machine learning models and converting them to solve business solutions would be an impossible task.

REFERENCES

1. https://aws.amazon.com/blogs/compute/continuous-deployment-to-amazon-ecs-using-aws-codepipeline-aws-codebuild-amazon-ecr-and-aws-cloudformation/

2. https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/putty.html

3. https://github.com/smeetvikani/Used-Car-Price-Predictor-Model

4. https://github.com/hamiltonchangcodes/Used_Car_Linear_Regression_Prediction