News Article Sorting

Objective:

The solution proposed here is a prediction model which will help us to find out the correct domain of a given news article using Natural Language Processing. This entire project is build using DVC (Data Version Control) and MLFlow for retraining, experimenting and model monitoring purpose.

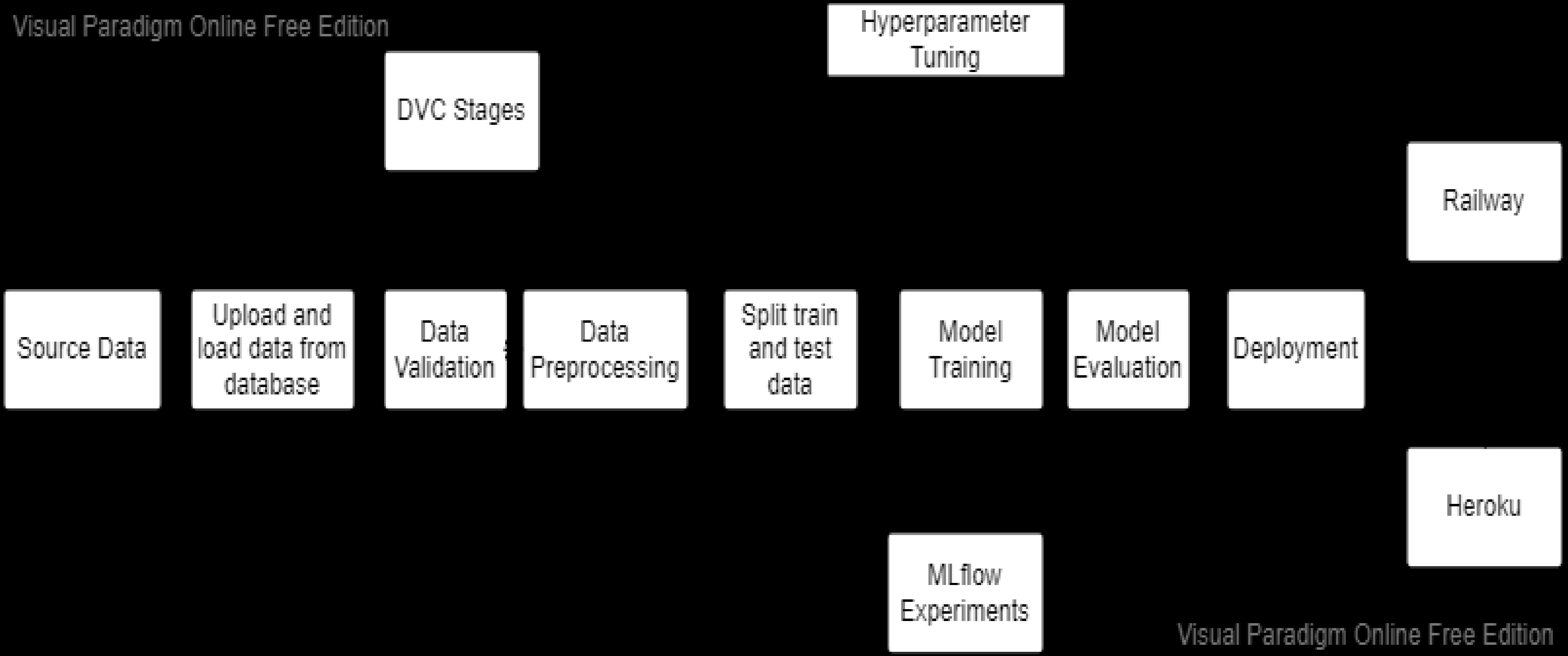
Benefits:

- News Domain Classification.
- Helps in maintenence of news article data.
- AI based News Applications.

Data Sharing Agreement :

- Sample file name (ex fraudDetection_20062021_101010)
- Length of date stamp(8 digits)
- Length of time stamp(6 digits)
- Number of Columns
- Column names
- Column data type

Architecture



Data Description:

The dataset used in this project is the BBC News Article Classification dataset .

The data is available in Kaggle Datasets.

Every transformation of the data is uploaded to and extracted from MongoDB

database. The dataset contains three fields, Ariticle ID, Text and Category.

Information of attributes of dataset as follows:

- ArticleID : The Unique ID of the article.
- Text : Text Article.
- Category : The Relative domain of the given text article.

Source Data:

- The source data used for this project is collected through Kaggle datasets - https://www.kaggle.com/competitions/learn-ai-bbc/data

Data Insertion into database:

- MongoDB database is used for this project as the primary source of storing and saving the data. get_data_from_database.py file is responsible for uploading and loading the data.
- Table Creation – ‘news_records’ named table or collection is created if not exists in the ‘News Article Sorting’ database in mongoDB.
- Data Insertion – The dataset is inserted into traffic records if any data is not found.
- Train Data – The training set upon each alteration is stored in the ‘train_data’ collection.
- Test Data – The testing set upon each alteration is stored in the ‘test_data’ collection.

Loading Data from database:

- After the source data is uploaded into database, data is loaded from the database and is stored in the raw data path.

Data Validation:

- Validating the data is an important part of the machine learning pipeline.
- Data is validated with respect to no. of columns, no. of rows, column names and its data types.
- If validation is successful, the data is further processed for transformation, otherwise, the stage is failed.

Data Transformation:

- Once data is validated, the data is passed for preprocessing.
- Below transformations are carried out in this stage:
    1. Handeling Null Values
    2. Removing Special Characters
    3. Removing Stopwords
    4. Stemming
    5. Other NLP feature engineering steps
- After the data is cleaned, the model ready data is transferred to the processed data path.

Splitting the data into training and testing :

- Before model training, the data is separated into training and testing data.
- For our model, the data split is 75% Training data and 25% Testing data..
- train_test_split from sklearn.model_selection is used to split the data.

Model Training:

- As we are solving a classification problem, after testing all the regression models we found that Random Forest Classifier was the best algorithm for our project.
- Through hyperparameter tuning, we tried to achieve best parameters and contribute to model retraining with continuously improved parameters.
- MLFlow experiment tracking is carried out at the same time for model experimentation.

Model Evaluation:

- Accuracy Score, Precision Score, Recall Score, F1 Score and Confusion Matrix are the metric systems used for model evaluation and experiment. Detailed report for each experiment metrics can be experimented using MLFlow.
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- Metrics and Parameters are also tracked each time the model is deployed using a yaml file.

Hyperparameter Tuning:

- To achieve the most accurate model, it is necessary to tune the model parameters continuously for improvised results.
- We have used RandomSearchCV for fast and continous model improvement.
- Random Forest Classifier parameters are played with different values for experimentation.

DVC:

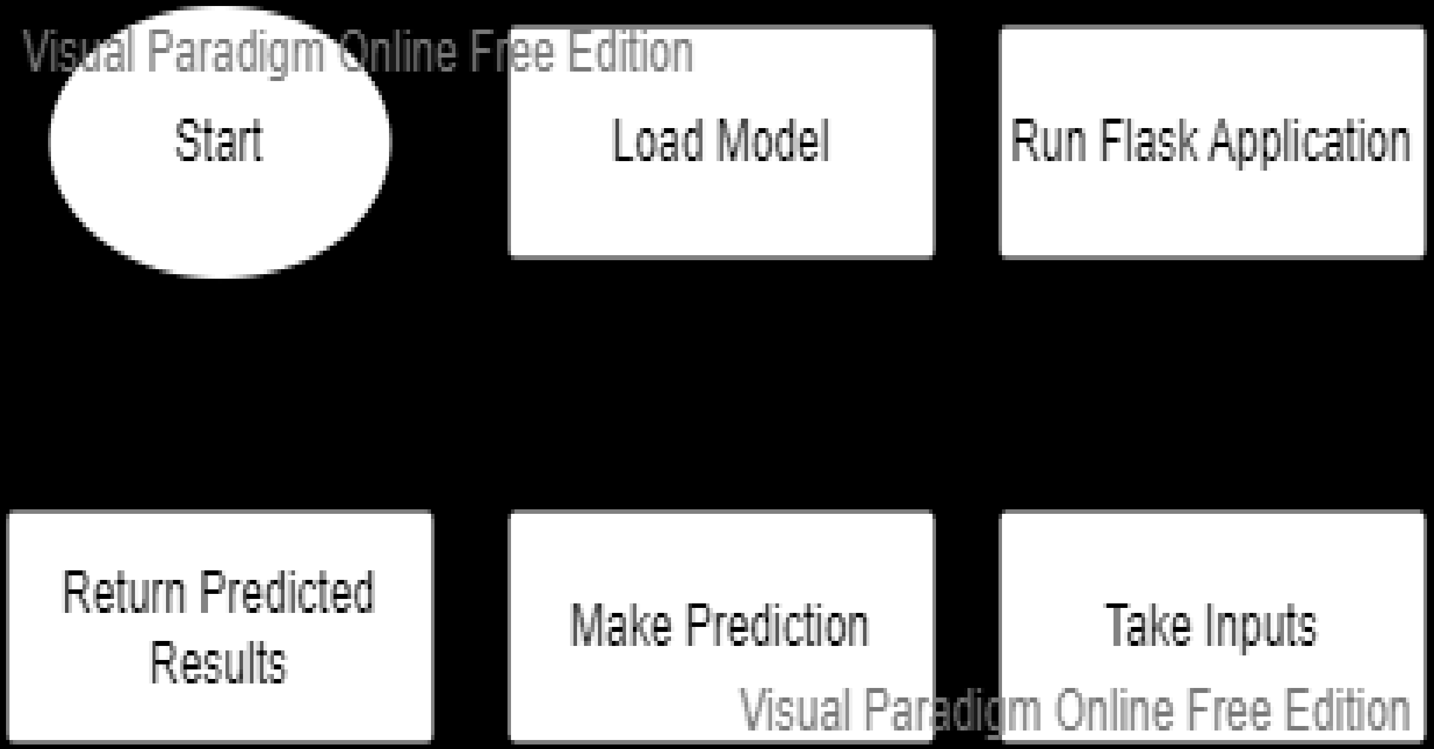
- DVC, which goes by Data Version Control, is essentially an experiment management tool for ML projects.
- DVC represents a complete machine learning pipeline with the help of different DVC stages.
- Stages, dependencies, parameters, metrics and outputs are defined in the dvc.yaml file to execute the DVC.

MLFlow:

- MLflow is a platform to streamline machine learning development, including tracking experiments, packaging code into reproducible runs, and sharing and deploying models.
- Parameters and metrics to log are defined while model training stage.
- Experimentation, model comparision, model version stages, etc. are some of the operation we can perform using MLFlow. Model retraining becomes possible using MLFlow.

Deployment:

- This project is deployed on cloud platforms such as Railway, Heroku and Render.
- Below is the deployment flow chart:



Prediction:

- Our project aims to make prediction via two types of response:
  - Prediction Form
  - API Response
- For Prediction form
  - Enter all the input values in the guided range.
  - Click the prediction button.
  - The prediction is printed in the prediction block.
- For API Response
  - Use the deployed app link as the API for prediction.
  - Provide the input in json format.
  - Get the result in a dictionary format.

Q & A:

Q1) What’s the source of data?

The source data used for this project is collected through Kaggle datasets - https://www.kaggle.com/competitions/learn-ai-bbc/data

Q 2) What was the type of data?

The data was in textual format.

Q 3) What’s the complete flow you followed in this Project?

Refer slide 5th for better Understanding

Q 4) How logs are managed?

We are using custom logs as per the steps that we follow in validation and modeling like File validation log , Data Insertion ,Model Training log , prediction log etc.

Q 5) What techniques were you using for data pre-processing?

Some Preprocessing steps used for the project as follows:

1. Handeling Null Values
2. Removing Special Characters
3. Removing Stopwords
4. Stemming
5. Other NLP feature engineering steps

Q 6) How training was done or what models were used?

- With the model ready data, we trained the data with all the regression algorithms to find the best model.
- Random Forest Classifier was found the best model.
- Hyperparameter Tuning was performed for finding the best parameters for Random Forest Classifier model.
- Parameters and Metrics were logged in the MLFlow for experimentation.

Q 7) How Prediction was done?

The inputs were provided on either the prediction page or through API response. We perform the entire lifecycle till the model is trained and evaluated. In the end we accumulate the data for prediction.

- Q 8) What are the different stages of deployment?
  - Prepare the model to deploy.
  - Validate the ML Model.
  - Deploy the model.
  - Monitor the model.