CAPSTONE PROJECT

PREDICTING ELIGIBILITY SCHEME FOR NSAP SCHEME USING MACHINE LEARNING

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OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

PROBLEM STATEMENT

34.The National Social Assistance Program (NSAP) is a flagship social security and welfare program by the Government of India. It aims to provide financial assistance to the elderly, widows, and persons with disabilities belonging to below-poverty-line (BPL) households. The program consists of several sub-schemes, each with specific eligibility criteria. Manually verifying applications and assigning the correct scheme can be a time consuming and error-prone process. Delays or incorrect allocation can prevent deserving individuals from receiving timely financial aid. Your task is to design, build, and evaluate a multi-class classification model that can accurately predict the most appropriate NSAP scheme for an applicant based on their demographic and socio-economic data. The goal is to create a reliable tool that could assist government agencies in quickly and accurately categorizing applicants, ensuring that benefits are delivered to the right people efficiently.

PROPOSED SOLUTION

- The solution involves building a multi-class classification model using IBM Cloud Lite to predict the appropriate NSAP scheme (Scheme code) based on regional demographic data. It includes data preprocessing, model training and deployment for real-time application.
- **Data Collection:**
  - Gather historical data contains year, male and female count, caste wise count , Total Aadhaar and Mobile Number Count and so on.
  - If possible, Integrate additional socio economic indicators or census data to enhance prediction accuracy.
- **Data Preprocessing:**
  - Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies.
  - Perform feature engineering to compute ratios (i.e. Gender or caste percentage) to enhance model learning.
- **Machine Learning Algorithm:**
  - Implement a Multi-class classification algorithm such as Random Forest or Decision Trees to predict the Scheme code and also train the model using the demographical and regional features.
  - Use cross validation and grid search for hyperparameter tuning. Consider using feature importance method to interpret which regional factors most strongly influence scheme classification to improve prediction accuracy.
- **Deployment:**
  - Deploy the model using IBM Cloud lite services such as Watsonx.ai studio service. Develop user friendly web dashboard to allow real time prediction.
  - Deploy the solution on a scalable and reliable platform, considering factors like server infrastructure, response time, and user accessibility.
- **Evaluation:**
  - Assess the model's performance using appropriate metrics such as accuracy, precision, recall and F1 score or other relevant metrics.
  - Fine-tune the model based on feedback and continuous monitoring of prediction accuracy.
  - The model accurately predicts the appropriate NSAP scheme for applicants based on regional demographic data, improving efficiency and reducing manual errors.

SYSTEM APPROACH

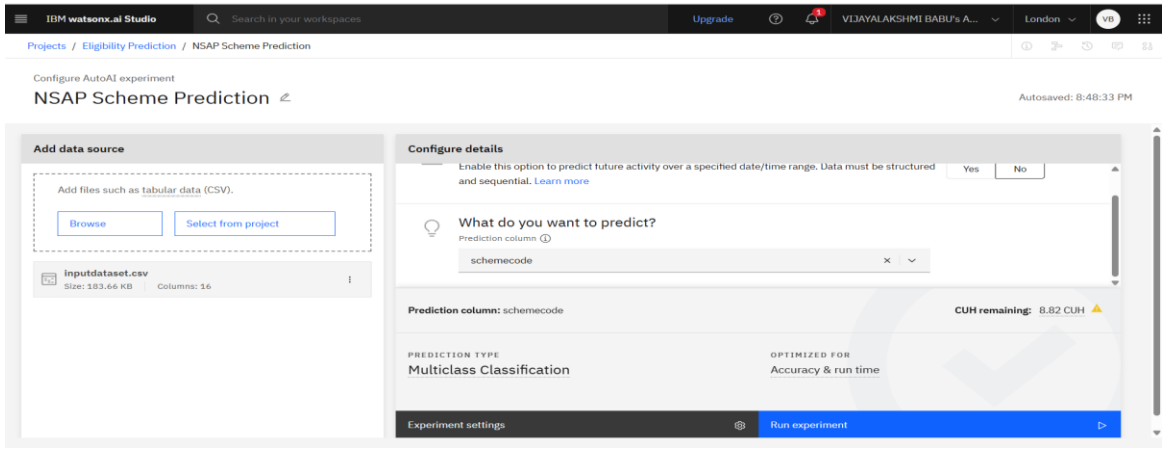
The "System Approach" outlines the architecture and methodology used to design and implement the NSAP Scheme Eligibility Prediction System using machine learning.

- **System requirements**
- Platform: IBM Cloud(Watsonx.ai Studio Service)
- Environment: IBM Auto AI Model
- Storage: IBM Cloud Object Storage
- **Library required to build the model**
- IBM Cloud Auto AI automatically manages and integrates the following components such as Data Preprocessing pipelines, Feature Engineering modules, model selection algorithms, hyperparameter Optimization, model deployment tools.
- We need to upload our dataset and select our target column. The rest of the pipeline is built automatically, ensuring speed, consistency and accuracy.

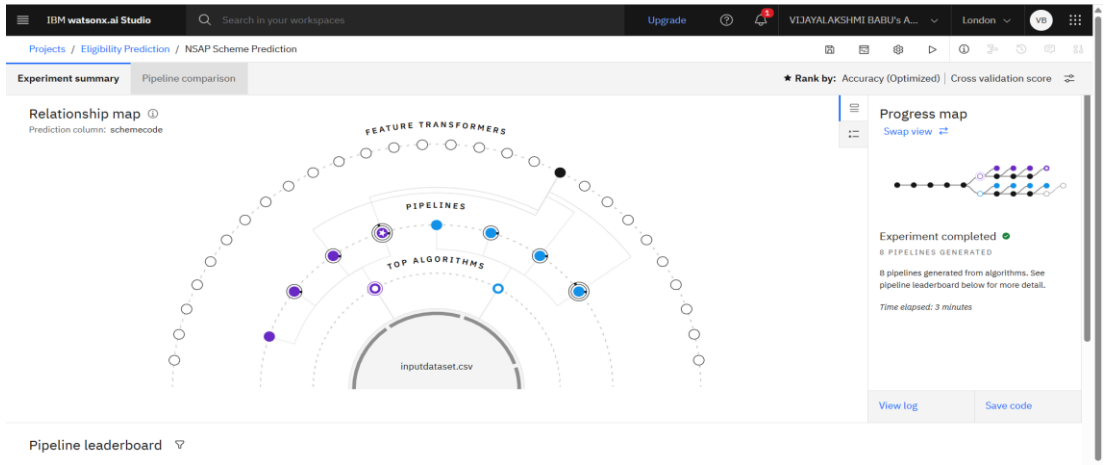
ALGORITHM & DEPLOYMENT

- In the Algorithm section, describe the machine learning algorithm chosen for predicting the NSAP Scheme. Here's is a detailed structure for this section:
- **Algorithm Selection:**
  - For predicting the NSAP scheme eligibility, the Snap Random Forest Classifier was selected due to its robustness in handling categorical data and its high accuracy in classification tasks. It reduce overfitting and handle missing values effectively, making it ideal for social welfare eligibility data.
- **Data Input:**
  - The model was trained using features from applicant data such as age, gender, income group, disability status and other socio economic indicators. These features represent the demographic profile of each region.
- **Training Process:**
  - The dataset was first split into training and holdout sets. The training data went preprocessing and hyperparameter optimization. Multiple model pipelines were automatically generated using IBM Auto AI and cross-validation was employed to ensure the accurate prediction. The best-performing pipeline was selected based on accuracy metrics.
- **Prediction Process:**
  - Once trained, the model predicts the most suitable NSAP scheme code for new applicant entries. The deployment phase enables real time inference by integrating the model into cloud-based application ensuring fast, scalable decision-making.
  - The trained Snap Random Forest Classifier model predicts the appropriate NSAP scheme IGNDPS, IGNOAPS or IGNWPS for new applicants. Based on holdout data evaluation, the model achieved 97.7% overall accuracy, with individual class accuracies of 97.1% (IGNDPS), 95.9% (IGNOAPS), and 100.0% (IGNWPS), confirming strong performance in multi-class classification for scheme eligibility.

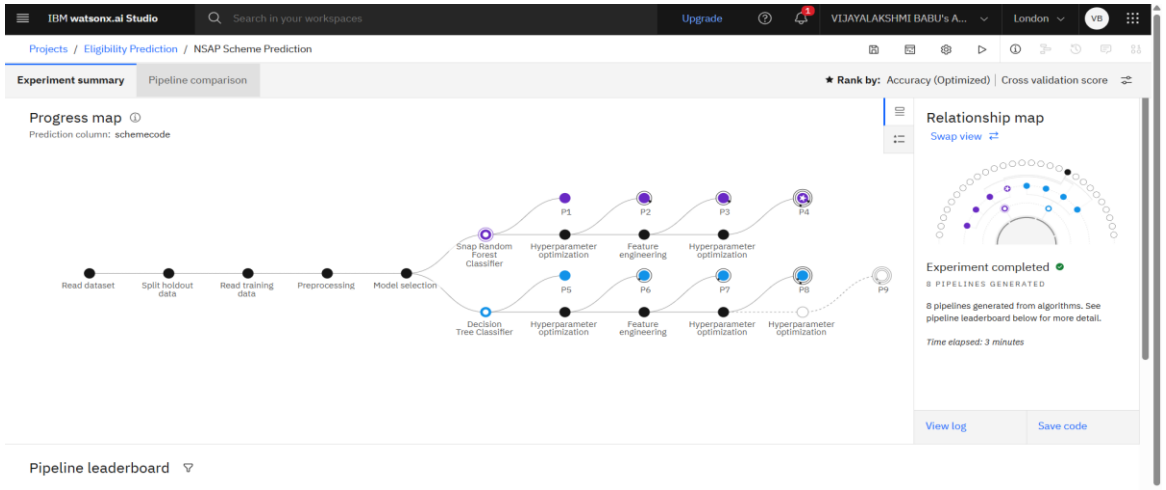
RESULT



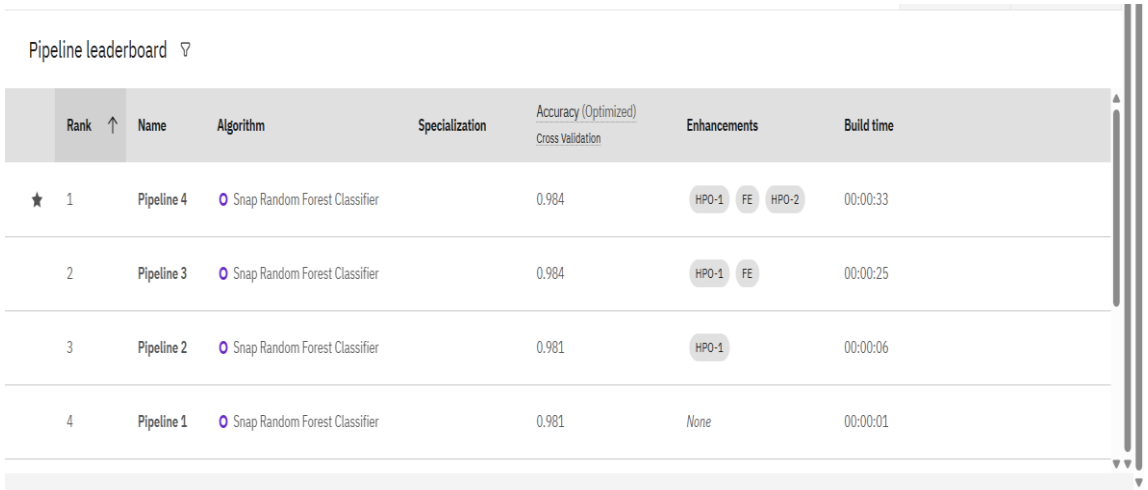
Select the target column and run the Multiclass classification exp



Relationship Map for NSAP Scheme Prediction by IBM Cloud



Progress map for NSAP Scheme prediction by IBM Cloud



Multiple pipelines created by our Auto AI model to analyze

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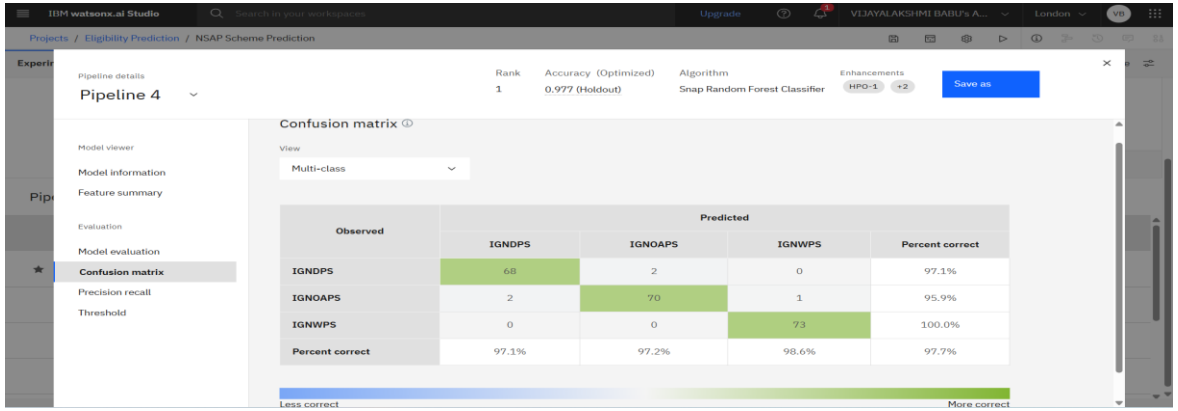
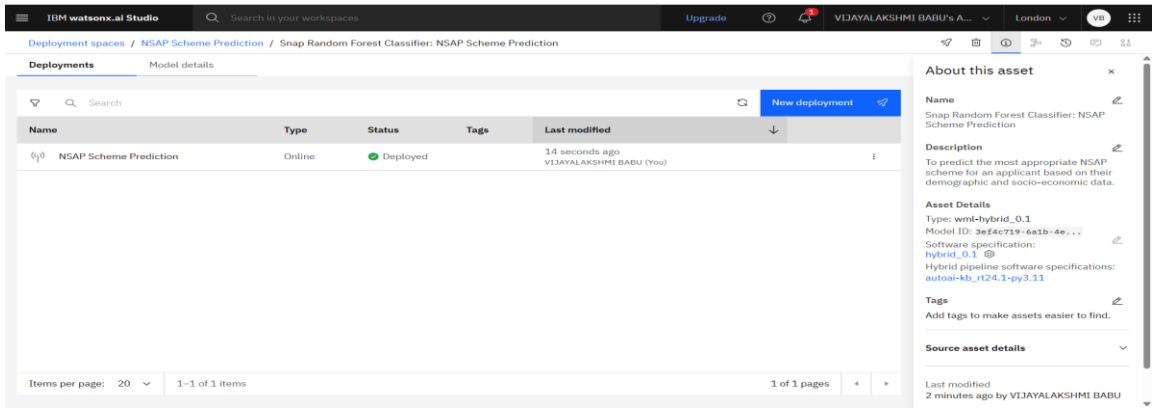
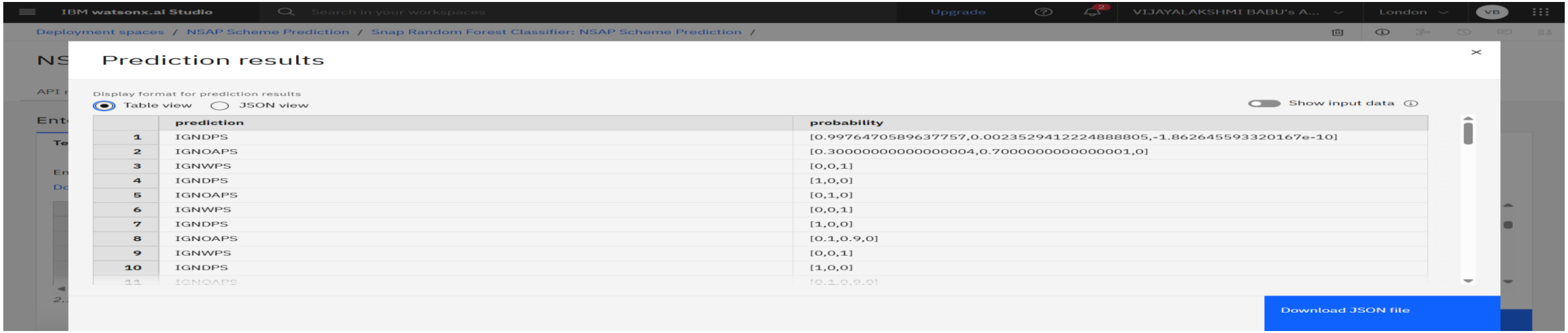
RESULT



Model Evaluation Metrics: Confusion Matrix



Trained Model deployed in IBM Cloud



Trained model accurately predicts the appropriate NSAP scheme for applicants based on regional demographic data.

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CONCLUSION

- The NSAP Scheme Prediction project effectively utilized IBM Cloud Auto AI to automate the classification of applicants into appropriate government welfare schemes. By analyzing historical data, the system accurately predicted eligibility for schemes like IGNOAPS, IGNWPS, and IGNDPS, achieving a high accuracy of **97.7%** on holdout data.
- Hence, this model demonstrates a strong performance and potential for scaling within welfare distribution systems. Accurate eligibility prediction can significantly enhance the efficiency and transparency of social assistance delivery.

FUTURE SCOPE

- The project can be expanded by integrating richer datasets which includes socio-economic and digital access indicators to enhance prediction accuracy. It involves deploying the model in real-time government portals for automated scheme recommendation.
- Incorporating AI model ,can improve transparency and trust in decision-making.
- Github repository Link:https://github.com/Viji-2003/NSAP_Scheme_Prediction.git

REFERENCES

- Ministry of Rural Development, Government of India. National Social Assistance Programme (NSAP) guidelines and scheme structure.
- R. B. Patel, “Machine Learning Techniques for Social Welfare Scheme Prediction,” International Journal of Computer Applications, 2021.
- IBM Documentation : Using Auto AI on IBM Cloud to Build Predictive Models, IBM Cloud Docs, 2023.

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