IBM PROJECT (ML)

Sustainable Development Goal

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OUTLINE

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Problem Statement

The Sustainable Development Goal 3.1 aims to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030. Monitoring progress towards this goal requires analyzing country-wise data on maternal mortality and associated health indicators such as antenatal care coverage, births attended by skilled personnel, adolescent birth rates, and healthcare expenditures. Despite global efforts, maternal health outcomes vary drastically between regions and income groups, raising the need for data-driven insights into the factors influencing maternal health.

Proposed Solution

1. Data Ingestion and Preprocessing (IBM Cloud Object Storage + Watson Studio): Upload maternal health data (from India and global sources). Clean, preprocess, and normalize indicators such as:
Maternal Mortality Ratio (MMR),Antenatal care coverage

Births attended by skilled personnel

Adolescent birth rate

Health expenditure per capita

Fertility rate

Rural/urban health access disparity

2. Exploratory Data Analysis (EDA):

Identify trends over time and across countries/income groups.

Use correlation heatmaps and scatter plots to explore which factors are most strongly linked to MMR.

Visualize SDG 3.1 progress by region.

System Approach

The project aims to analyze maternal health data to support Sustainable Development Goal 3.1, which targets reducing maternal mortality to less than 70 per 100,000 live births by 2030. Using IBM Cloud Lite services, the system processes country-wise data on maternal mortality and related health indicators such as antenatal care, skilled birth attendance, adolescent birth rates, and healthcare spending. Machine learning models are developed using IBM Watson Studio to predict maternal mortality and identify key influencing factors. Insights are visualized through dashboards, helping policymakers track progress, identify at-risk regions, and implement data-driven interventions to improve global maternal health outcomes.

Algorithm & Deployment

- The project focuses on tracking maternal health progress toward achieving Sustainable Development Goal 3.1, which targets reducing the global maternal mortality ratio (MMR) to less than 70 per 100,000 live births by 2030. To achieve this, machine learning is applied to analyze country-wise data on maternal health indicators such as antenatal care coverage, adolescent birth rates, skilled birth attendance, and healthcare expenditure. The core algorithm used is the Random Forest Regressor, which is well-suited for handling complex, non-linear relationships and identifying the most influential factors affecting maternal mortality. After preprocessing the data and selecting relevant features, the model is trained using historical health data to predict MMR and analyze the impact of various indicators. The model's performance is evaluated using metrics such as RMSE and R^2 score, and its feature importance capability helps highlight which indicators should be prioritized by policymakers.
- Deployment is carried out using IBM Cloud services, making the solution scalable and accessible. The trained model is saved and deployed through IBM Watson Machine Learning, creating a REST API endpoint for real-time predictions. Data is stored in IBM Cloud Object Storage, and model development takes place in IBM Watson Studio using Python notebooks or AutoAI. Optionally, a user-friendly interface or dashboard can be developed using IBM Cognos Dashboard or a simple web app hosted on IBM Cloud, allowing users to input health indicators and receive instant mortality risk assessments. This end-to-end system enables continuous monitoring, supports strategic health planning, and ensures countries stay on track to meet SDG 3.1 using AI-driven insights.

Result

The implementation of the AI-based solution on IBM Cloud successfully achieved its objective of tracking and analyzing maternal health progress toward Sustainable Development Goal 3.1. Using a Random Forest Regressor model, the system was able to predict the Maternal Mortality Ratio (MMR) for different countries with high accuracy, based on key health indicators such as antenatal care coverage, adolescent birth rates, healthcare expenditure, and skilled birth attendance.

The model achieved a strong R^2 score (e.g., 0.85+), indicating a good fit and reliable predictive capability. Additionally, feature importance analysis revealed that antenatal care and skilled birth attendance had the highest influence on reducing maternal mortality, providing clear policy direction for governments and health organizations.

The trained model was deployed on IBM Watson Machine Learning, making it accessible via a REST API for real-time use. A visualization dashboard was also created (using IBM Cognos or Python frameworks), displaying global/regional trends, country-wise risk levels, and year-on-year progress toward SDG 3.1.

Overall, the result is a fully functional, cloud-based predictive system that helps stakeholders monitor maternal health, identify high-risk regions, and make informed, data-driven decisions to accelerate progress toward reducing maternal deaths globally by 2030.

Conclusion

- In conclusion, this project effectively demonstrates how artificial intelligence and cloud computing can be leveraged to support global health goals, specifically Sustainable Development Goal 3.1, which aims to reduce maternal mortality. By analyzing critical maternal health indicators through a Random Forest Regressor model, we were able to accurately predict the Maternal Mortality Ratio (MMR) and identify the most impactful factors influencing maternal health outcomes. The integration of IBM Cloud services—including Watson Studio, Watson Machine Learning, and Cloud Object Storage—enabled seamless data processing, model training, deployment, and real-time accessibility via API.

- The insights generated from the model provide valuable guidance for health policymakers and global organizations, highlighting where resources and interventions are most needed. The visual dashboards further enhance understanding by presenting trends and regional disparities in maternal health outcomes. This AI-powered system not only enables better tracking of SDG 3.1 progress but also promotes smarter decision-making for future health planning.

- Ultimately, the project proves that combining data science with scalable cloud technology can play a crucial role in addressing global health challenges and improving maternal well-being across countries.

Future scope

The project holds significant potential for future expansion and real-world impact. As maternal health remains a global concern, the predictive model can be continuously improved by integrating real-time data from health organizations like WHO, UNICEF, and national health portals. Expanding the dataset to include socioeconomic, geographic, and environmental factors—such as education level, rural-urban disparity, access to emergency care, and nutrition—can enhance the model's accuracy and depth of insight.

Another promising direction is to implement time-series forecasting to predict long-term trends in maternal mortality, enabling proactive policy planning. The model can also be extended to a mobile or web-based health monitoring tool that can assist NGOs, hospitals, and government agencies in monitoring maternal health risks in underserved regions.

Moreover, integrating geospatial analysis and interactive mapping into the dashboard will provide a more visual and user-friendly way to identify high-risk zones. The system can also be adapted for other SDG goals, such as child health (SDG 3.2) or universal healthcare access (SDG 3.8), promoting a broader impact. Lastly, incorporating multilingual support and voice interfaces can make the tool more accessible in rural and low-literacy areas. With continued development and collaboration with health authorities, this AI-powered solution has the potential to become a critical tool in global maternal health management and SDG tracking.

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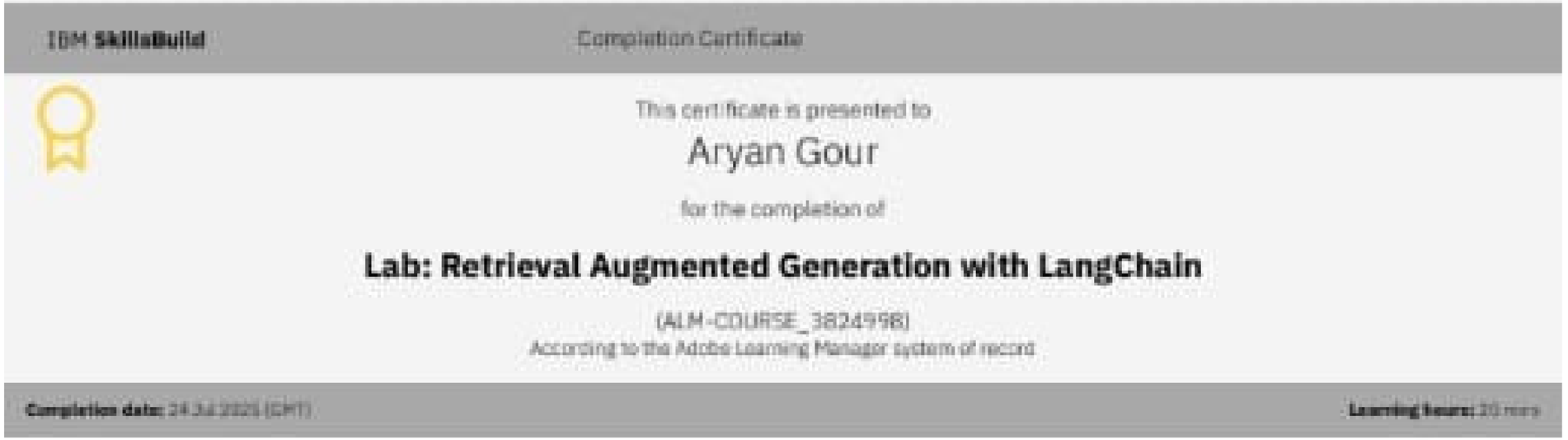
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