Number Recognition Models for Energy Management, towards achieving Energy Net-Zero goals.

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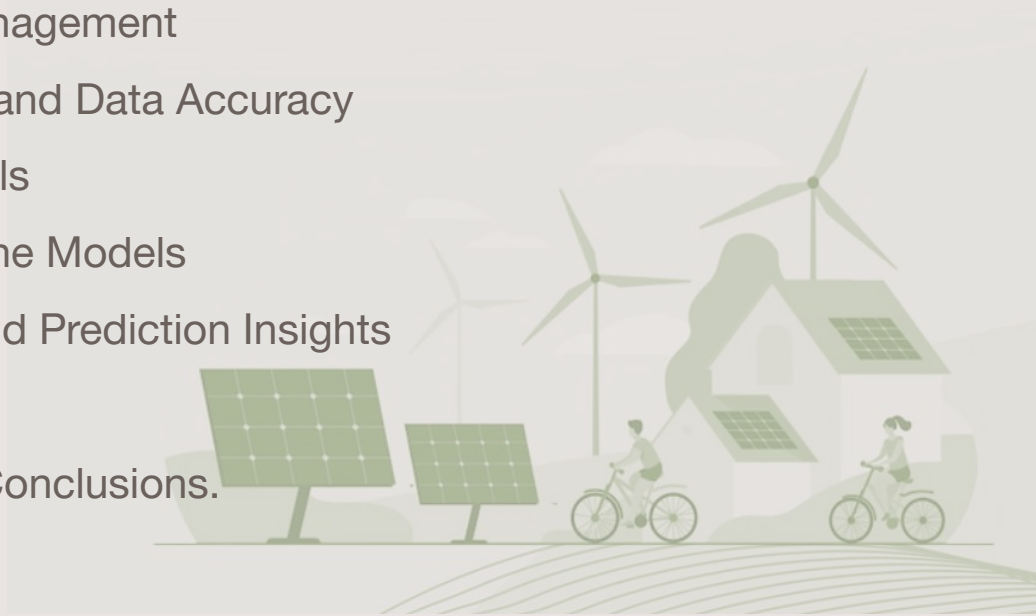
Agenda

- Net- Zero goals and and Energy Management
- Importance of Number Recognition and Data Accuracy
- Solution : Number recognition Models
- How it Works : Technology Behind the Models
- Benefits of Number Classification and Prediction Insights
- Stakeholder Impact
- Future Directions , Challenges and Conclusions.



Net Zero Energy Goals and Energy Management

- **Net Zero Energy** means using only as much energy as we can produce by renewable resources.
- **Net Energy Goal :** to reach net zero by **2050.**

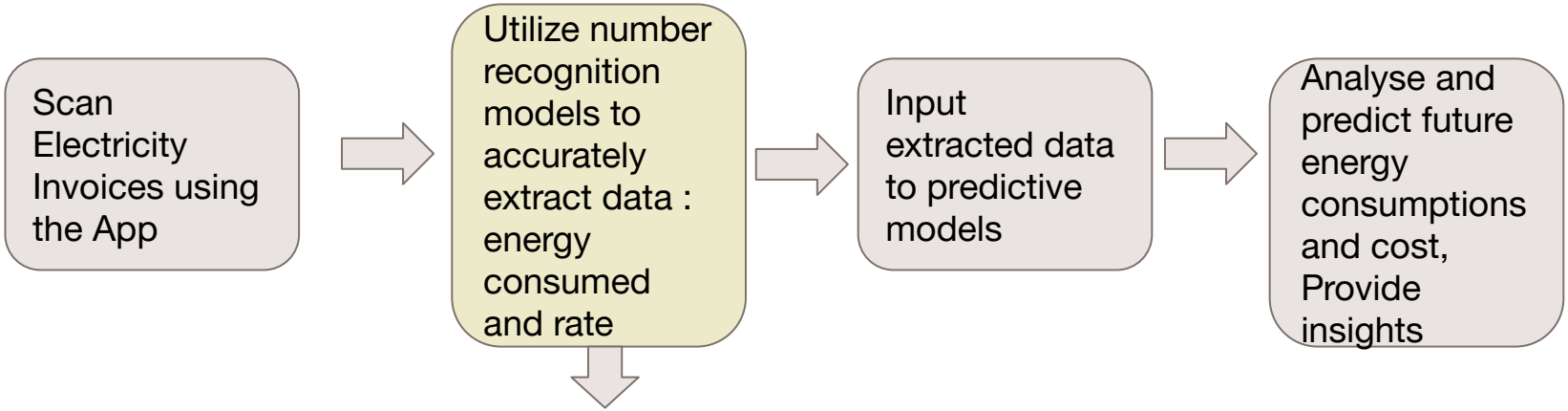
For achieving this we need to know:

- Know energy consumption and requirement of big corporations
- Energy charges.
- Predicting future energy requirement.

Importance of Number Recognition from the Energy Invoice.

- For predicting future energy consumption and cost associated with electricity, is important to accurately get the data such as electricity charges, unit consumed in the past months.
- These information is present in electricity invoice, hence scanning these numbers from the invoice accurately will help us get accurate numbers for our further data analysis and prediction.
- Here , Number recognition models can be used.

Solution : Number recognition model

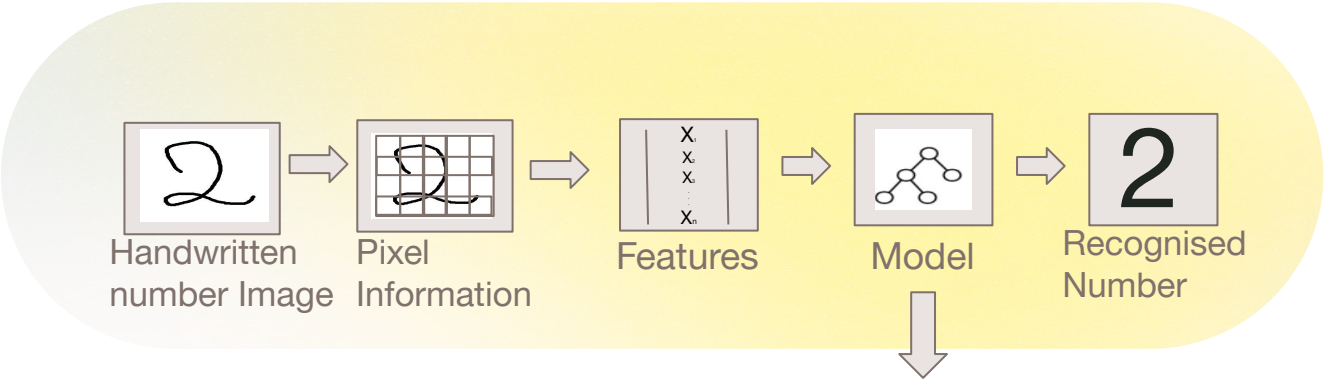


We will start by utilise basic classification models and then tune it further to enhance accuracy for recognising numbers from handwritten number dataset : EMNIST
KPI given is 87% accuracy

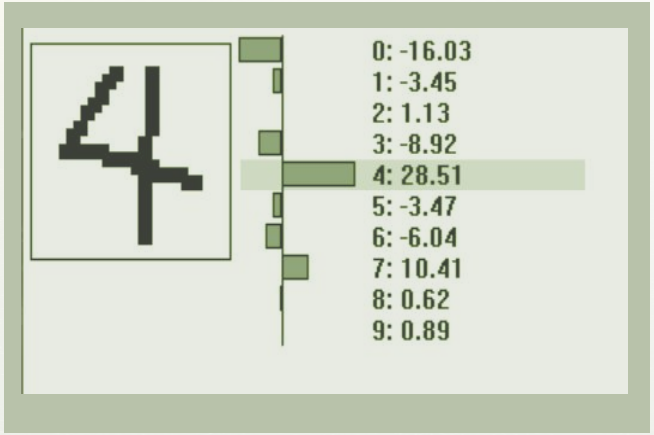
How it works: Technology Behind The Model

Taking different handwritten numbers from, MNIST dataset, utilising the pixels information as features and recognising the pattern of which number it represents:

28*28 = 784 features



Understanding Number Recognition (Classification) Model



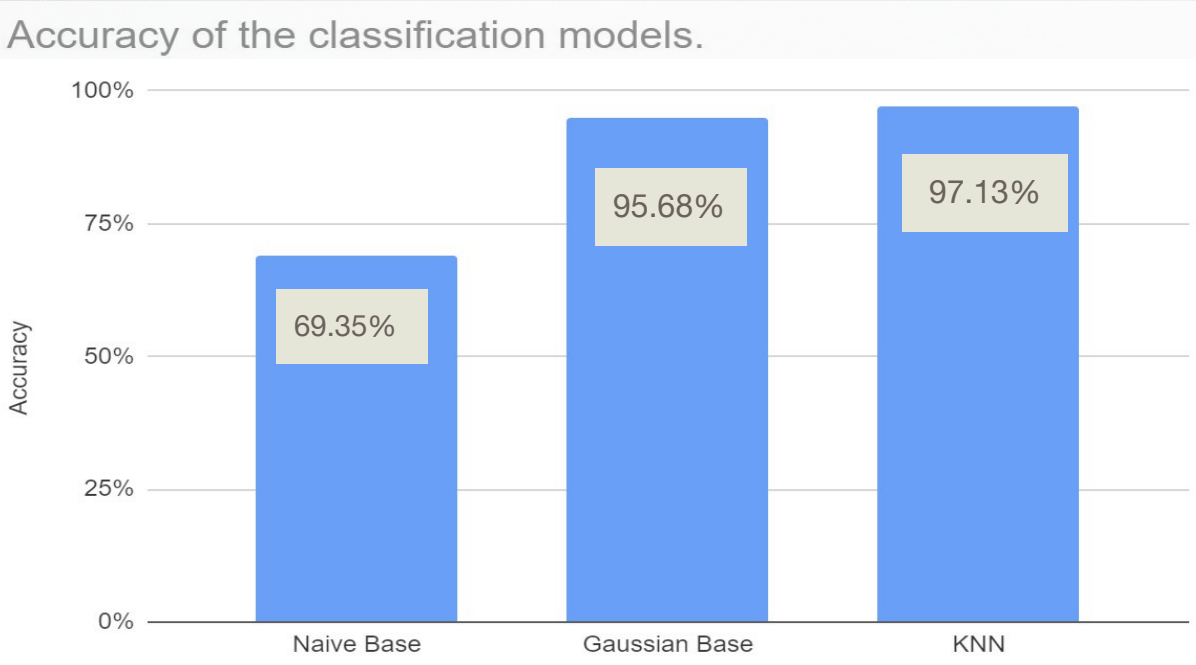
Classification Models used:

- Naive Base
- Gaussian Base
- K- Nearest-neighbours

The Bayesian classifiers predicts the class of a new example by calculating probabilities for each class and selecting the one with the highest probability. In contrast, KNN looks at the nearest neighbors of the new example to make its prediction.

Results of the classification model

Despite KNN achieving high accuracy, I would recommend implementing the Gaussian Bayes model due to its efficient performance, especially as the dataset size and feature complexity will increase in future.



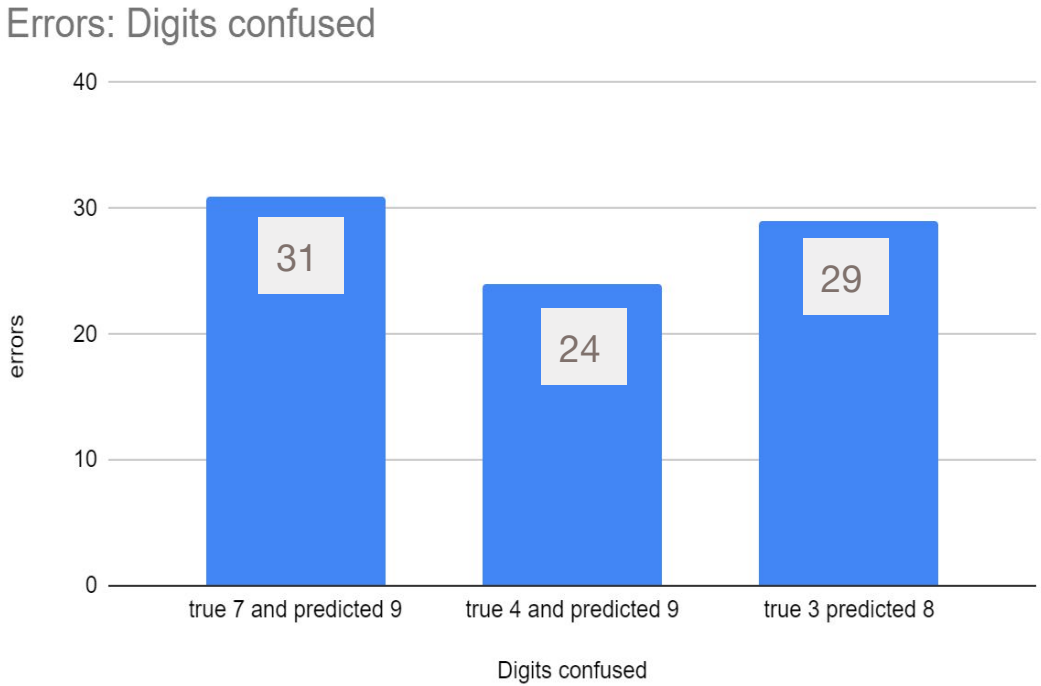
With tuning, good accuracy was achieved.

Error Analysis for Gaussian Base

True 9 and predicted 7

Future Improvements suggestions:

- **Apply Image Rotation and Noises**: By slightly rotating images and introducing noise, the model can better generalize
- **Utilize Data Augmentation:** If possible,we can enrich the model with diverse examples, improving its accuracy.



Benefits of Number Classification and prediction insights

- **Data driven Decision making:** Cost saving through the implementation of renewable energy decision.
- **Sustainability impact:** Helps organizations in transitioning to sustainable energy, which aligns with government net zero energy objectives.
- **Regulatory Compliance**: Aids in compliance with energy efficiency standards and regulations, minimizing the risk of penalties.
- **Cost Reduction**: Understanding of energy consumption trends aid in cost saving opportunities.

Stakeholders Impact

Large Commercial Enterprise

- Enhanced Energy Efficiency
- Improved Sustainability
- Cost Savings

Energy management Firms

- Business Opportunities
- Market Leadership and Client services.

Government Agencies

- Regulatory Compliance
- Environmental Conservation
- Economic Growth

Financial Institutions and Investors

- Investment Opportunities.
- Environmental, social, and governance Considerations, enhances investment portfolio.

Future Directions , Challenges and Conclusion

Future Directions

- Smart Grid Implementation
- Advancing Energy Management Through Predictive Analytics and Adaptive Learning

Challenges

- Data privacy,
- Cybersecurity risks,
- Scalability,
- Funding,
- Regulatory Compliance

Conclusions

Effective energy management is essential for maintaining sustainability, reducing expenses, and encouraging innovation, all of which contribute to a resilient energy future and a sustainable energy environment.

Q & A

Thank you for your attention