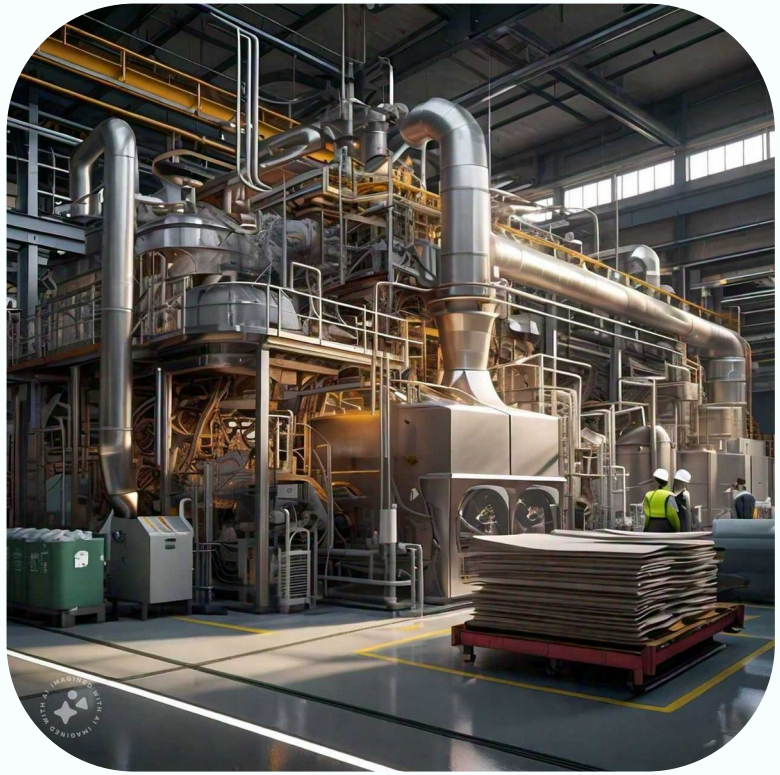
AI-Integrated Filtrate Turbidity Testing in Paper Manufacturing

AI... The story so far

Papermaking

Modern papermaking



Industrial papermaking

Source: Meta AI

AI... The story so far

Artificial Intelligence

Any technique that enables computers to mimic human intelligence

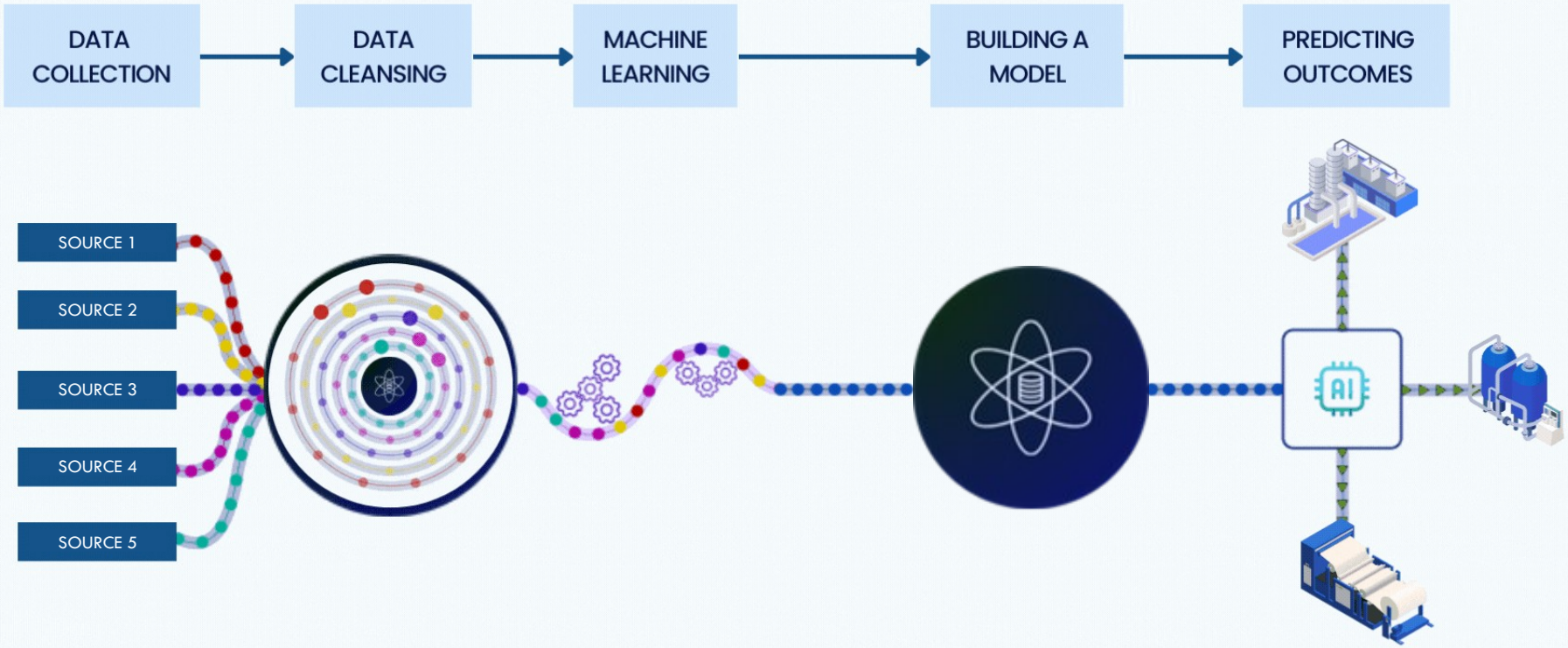
Machine learning

Subset of AI including all techniques that enable computers to learn from experience

Deep learning

Subset of ML that allows models to train itself, based on artificial neural networks

Progress through AI



AI could reach a new peak in the next five years, and could potentially pass any human exam or medical test. – Jensen Huang, CEO, NVIDIA

PadhAI, an AI application clears UPSC prelims with a score of 170/200. – ToI, June 17, 2024

Comparison with AI

	Manual Control	Advanced Process Control	Artificial Intelligence
Real Time Data	✗	✓	✓
Automated Control	✗	✓	✓
Higher Accuracy	✗	✓	✓
Continuous Learning	✗	✗	✓
Scalability	✗	✗	✓

Real-world example of using AI-ML-DL models for mill cost optimization

01

Charge demand is a critical parameter that is widely used for dosing various chemicals

02

Using AI, we can find parameters that gives good correlation with charge demand

03

Filtrate turbidity found to be a good proxy measurement option to charge demand estimation

Case study

AI-ML-DL models using filtrate turbidity testing as an effective alternative to charge demand estimation in coagulant dosing

Case study

The study was conducted at one of the Indian board manufacturers over a period of 100 days to find the possibility of a correlation between the filtrate turbidity and the charge demand

Target: Optimize coagulant consumption at the wet-end

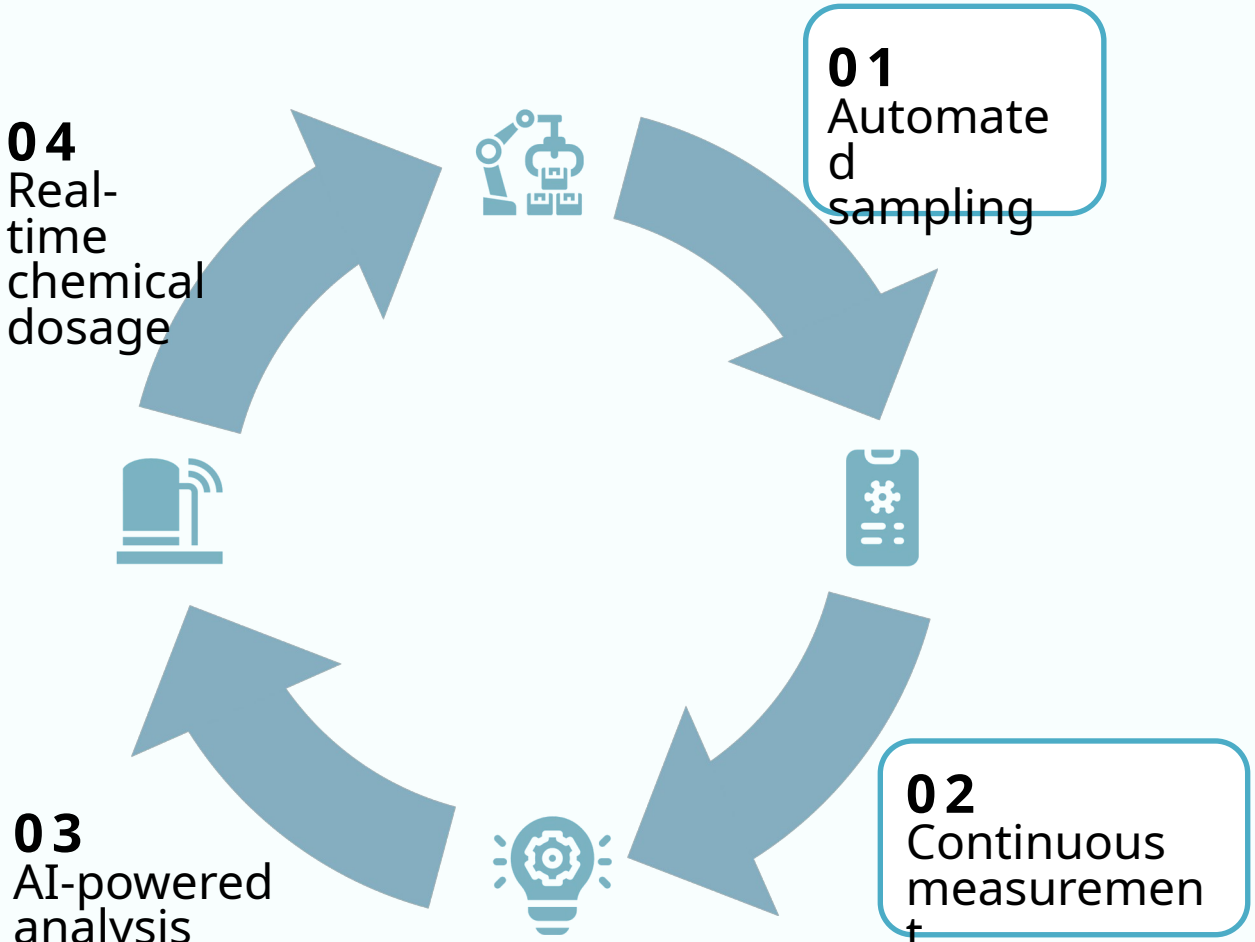
Requirements:

- Continuous and repeatable measurements
- Real time data collection and analysis
- Determine the correlation coefficient

Challenges in manual FTT

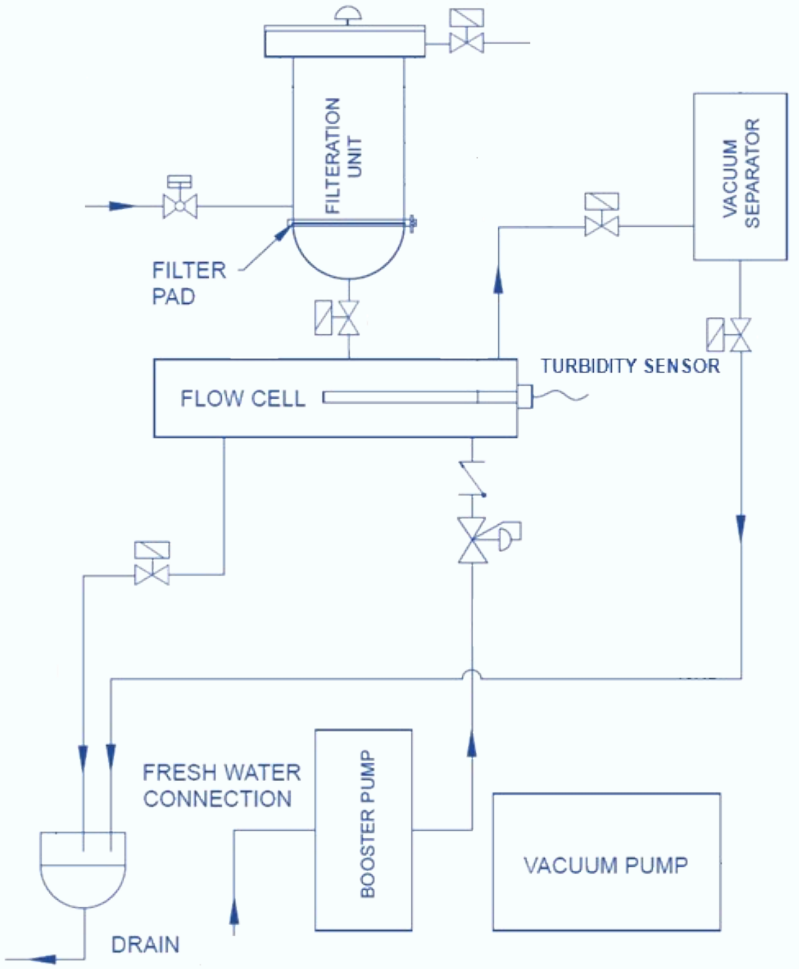
1. Delayed response and operational inefficiency
2. Intermittent data and process variability
3. Limited and inconsistent data
4. Increased operational costs
5. Sub-optimal chemical utilization

AI-powered chemical dosing

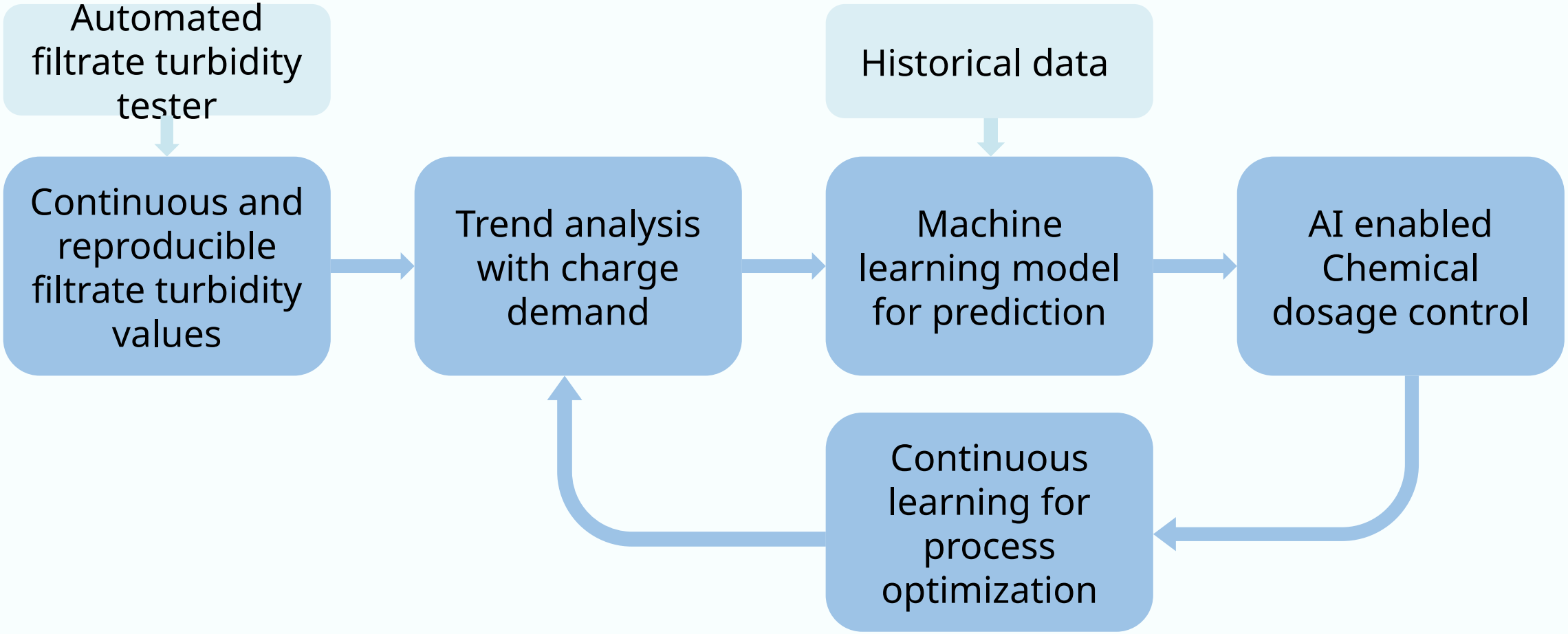


Automated filtrate generator

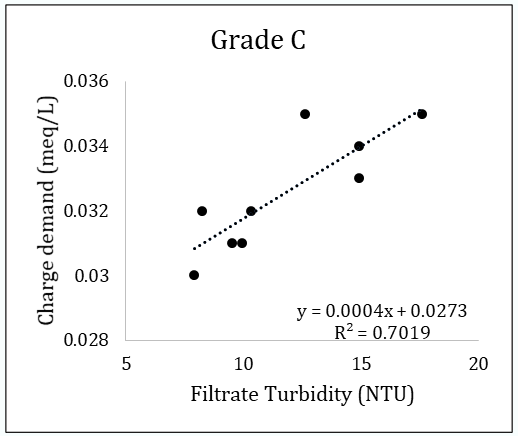
- Automated continuous sampling from the process line
- Supernatant generation from pulp samples of 0.05% – 5% consistency
- Filter pore size can be selected to match existing filter paper
- Reusable SS filter & Automated backwash cycle
- Inbuilt flow cell for various sensors

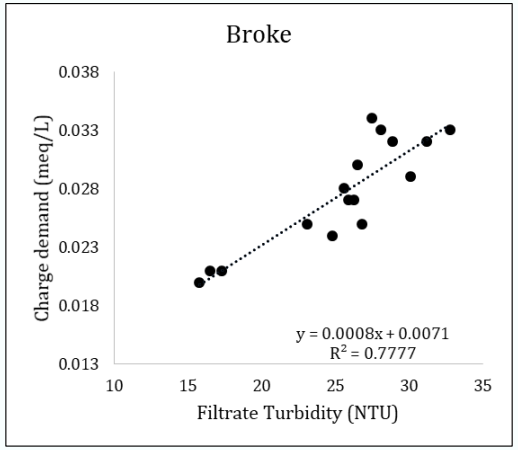


Functional block diagram

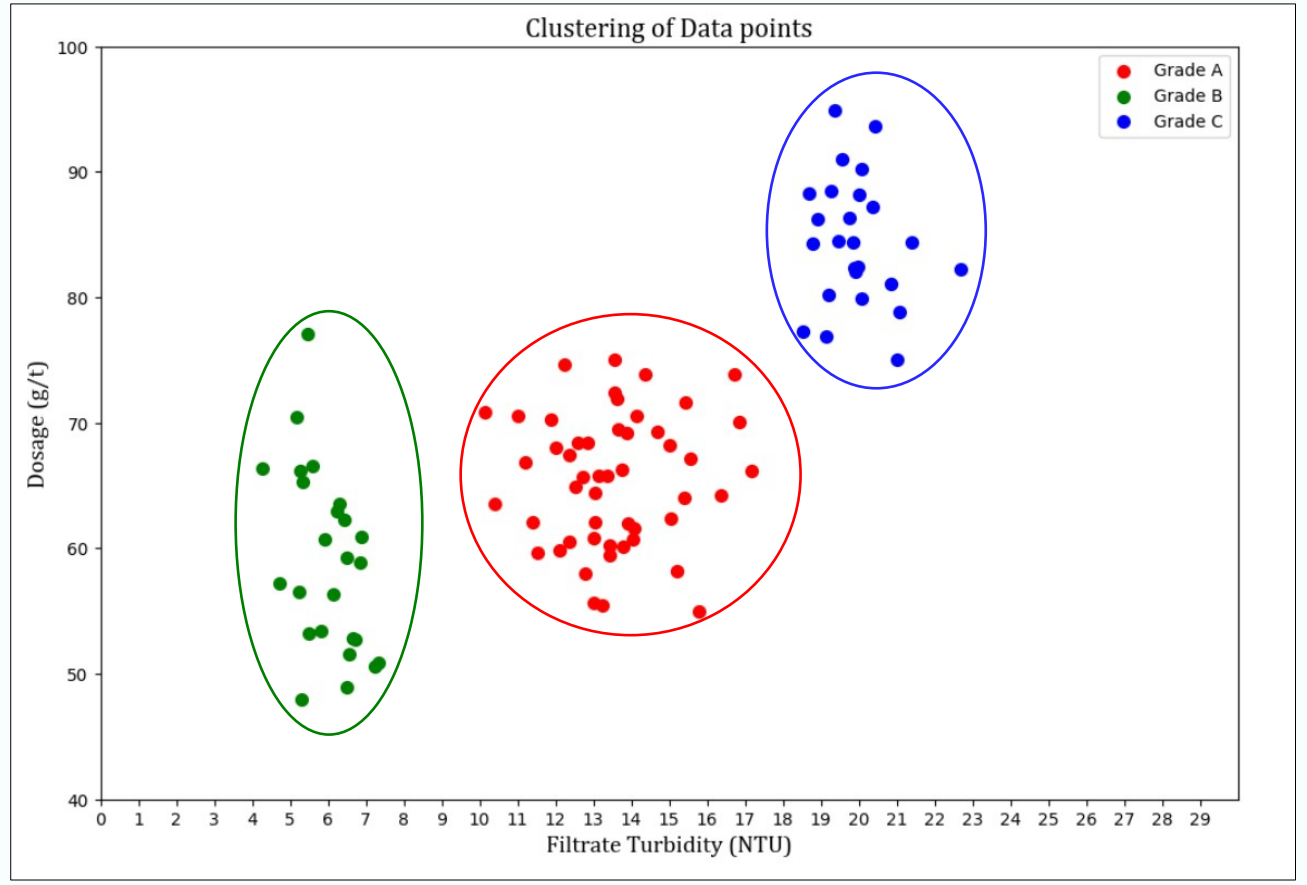


Analysis



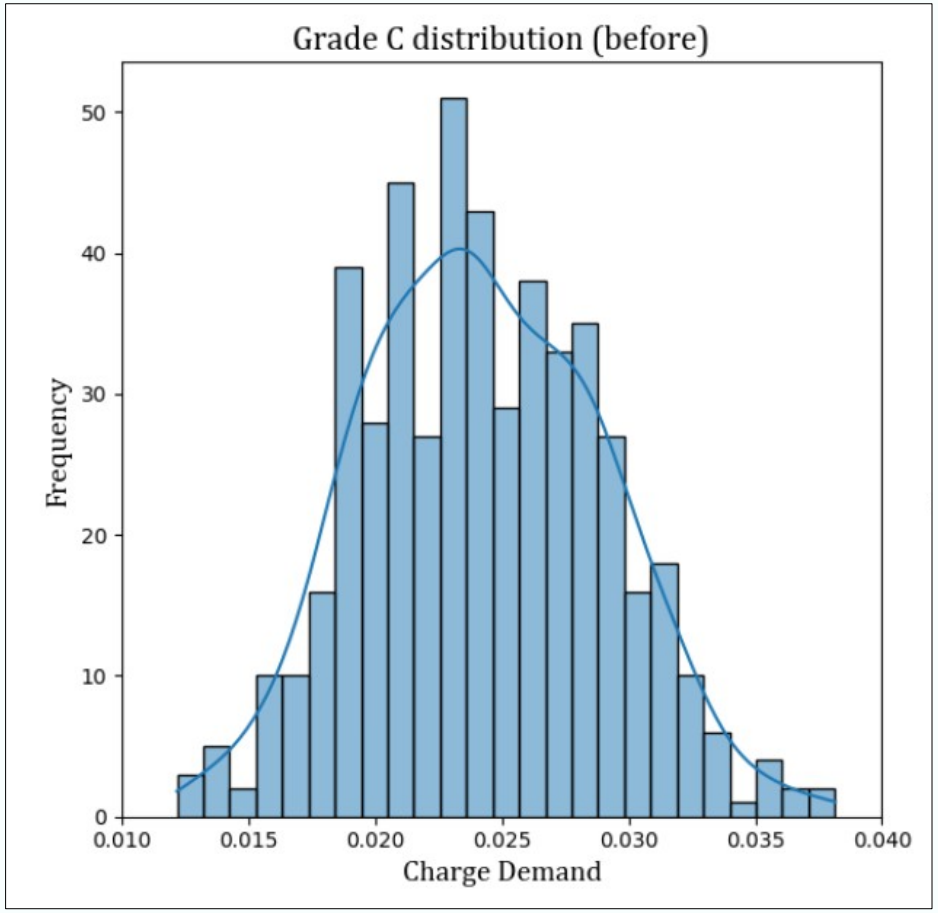


Trend analysis with charge demand

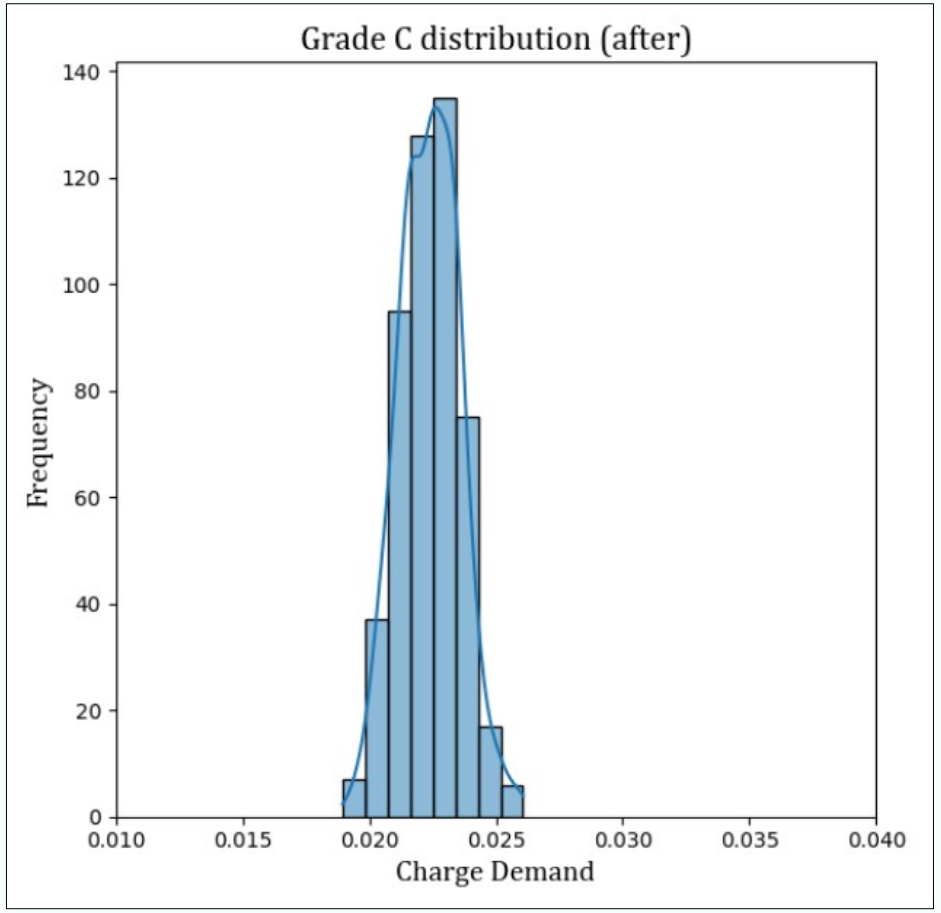


Clustering of the dosage values vs filtrate turbidity values

Analysis



Before AI Model Implementation



After AI Model Implementation

Conclusion

- A reduction in retention variation and a **2-4%** improvement in ash retention, was observed
- Stable and improved fibre retention (**5%**) and filler retention (**3%**) was observed
- Using the FTT unit to predict dosage vis-à-vis charge analyzer resulted in significant savings of more than Rs. **75 Lakhs** annually

Summary

- Turbidity measurement can be used as a proxy measure to control coagulant dosage
- Automated FTT addresses manual turbidity testing issues, with repeatable and reliable measurements
- Precise dosage control achievable due to real-time data collection through continuous monitoring

THANK YOU!