Finarb

Finarb Analytics Consulting

"Creating Impact Through Data & AI"

Webinar

Improving Productivity and Efficiency for Pharmacies through AI and Automation

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Wednesday December 6th 2023

9:00 -10.00 AM PST

Art Swanson
Former VP of Product Development,
Parata Systems

Adam Docrat
Head of IT - Aster Retail GCC,
Aster Pharmacy

Anuj Chatterjee
VP of Data Science,
Finarb Analytics Consulting

REC This session is being recorded

Audience is muted

Q A Audience Q&A

https://finarbconsulting.com/

Finarb

Finarb Analytics Consulting

"Creating Impact Through Data & AI"

Technology Consulting	Data Engineering	AI & ML Solutioning	Application Development	Automation Solutions

OUR CLIENTS

Parata | teva | FRAZIER HEALTHCARE PARTNERS | cps

PCCI | Apollo Intelligence | SOLIS Mammography | Synergy Medical A Parata Company

South Side Specialty Pharmacy | veinclinics of America | P&G | BMW

Wharton University of Pennsylvania | Swissquote | Black Diamond Risk | GETCAPITAL

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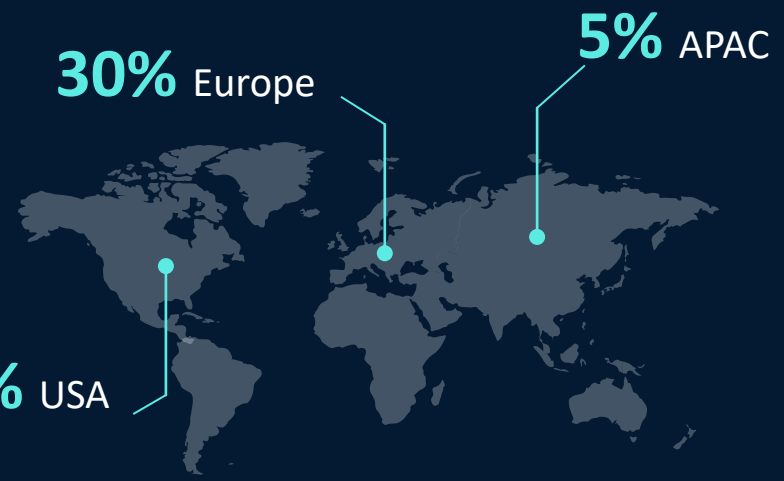
OUR TOP VERTICALS

- Healthcare: 55%
- BFSI: 20%
- Retail: 10%
- Manufacturing: 10%
- Others: 5%



Agenda

Art Swanson (Former-VP of Product Development, Parata Systems)

- Validating Contents Pills inside a packaged pouch- Detection and Classification of pills, Inspecting the labels, Counting the number of pills
- Error Detection in Pills- Broken Pills in Pouches, Debris in Pouches, Double Pills in Blister Packaging
- Real-time detection of pills within the workflow of the dispensing machine to avoid the cascading effect

Anuj Chatterjee (VP of Data Science, Finarb Analytics Consulting)

- AI-based routing solution to optimize the workflow in a Pharmacy
- Using Real World Data to Track adherence and monitoring
- Predictive Maintenance (Error Prediction and RUL prediction)

Adam Docrat (Head of IT- Aster Retail GCC, Aster Pharmacy)

- AI in Inventory Management
- AI in Route Planning- Logistics
- Future of Pharmacy Automation

Audience – Q&A

Art Swanson

(Former VP of Product Development, Parata Systems)

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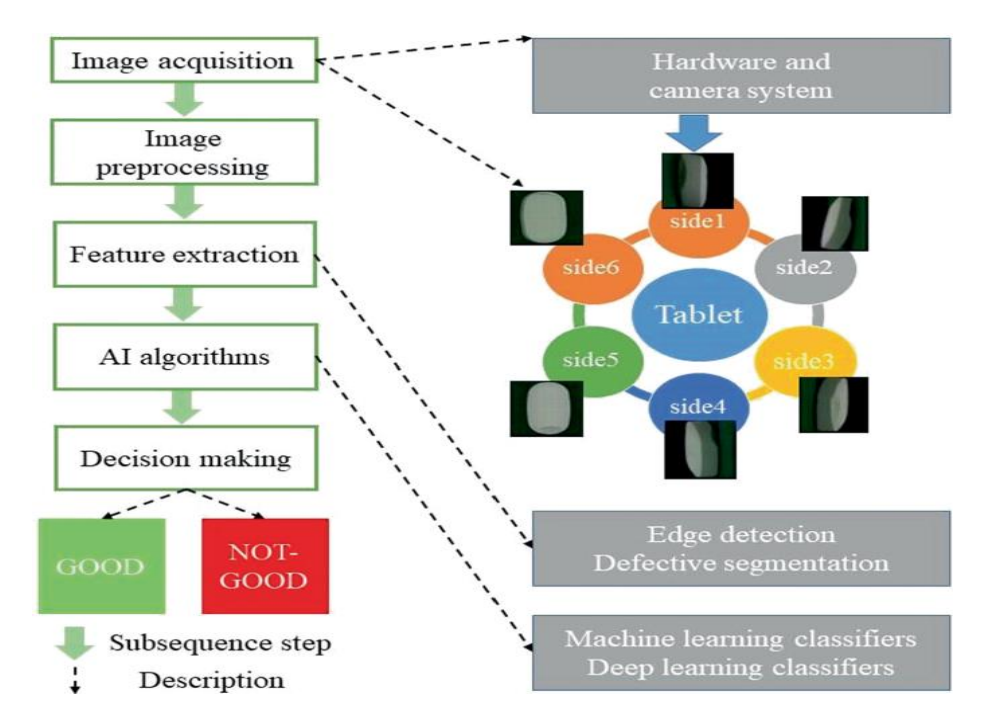
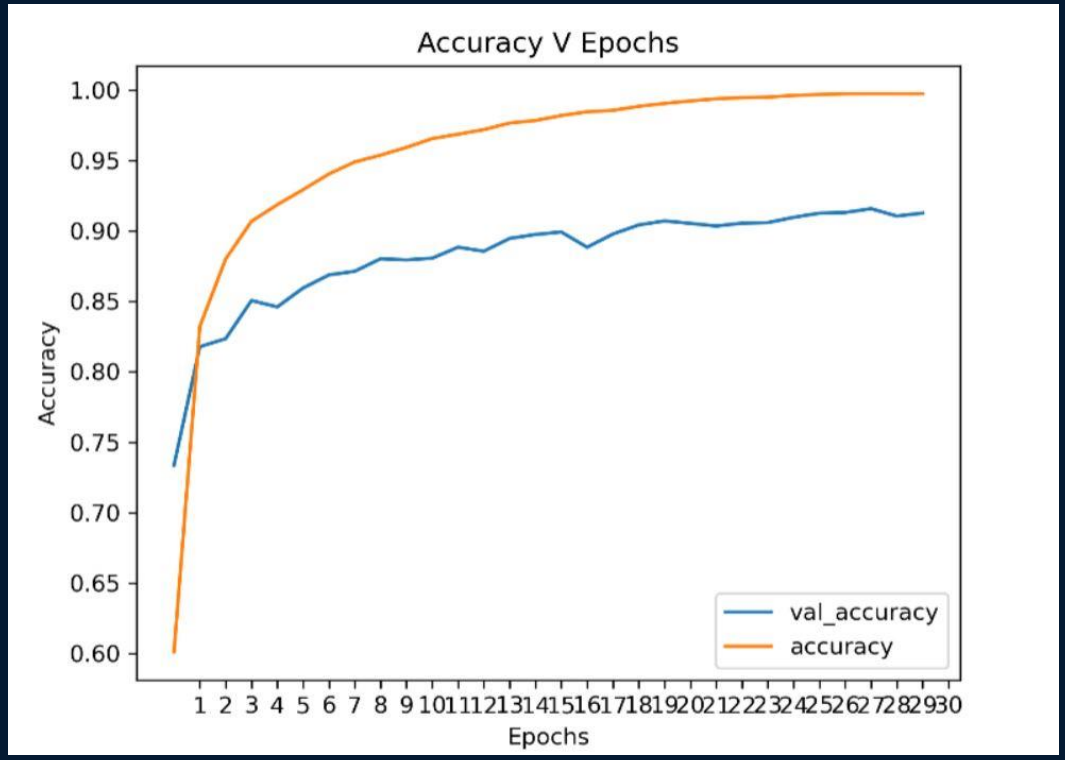
Computer Vision Based Solutions

Automated inspection systems have been in use in pouch packaging pharmacy automation for almost **20 years.**



The computer vision-based approach is trained by the customers and is individualized for each machine. This can lead to inconsistent performance across inspection devices and the accuracy can be impacted by the quality of the local training.



The Computer vision-based approach has been shown to be about **90%** accurate over time. This would mean that roughly **10%** of the pouches would need to be validated by a pharmacist. The actual rate of errors for these machines is roughly **1%** - which means that **90%** of the pharmacist inspections are for pouches that are actually correct

Validating Contents in the Pouch

Challenges

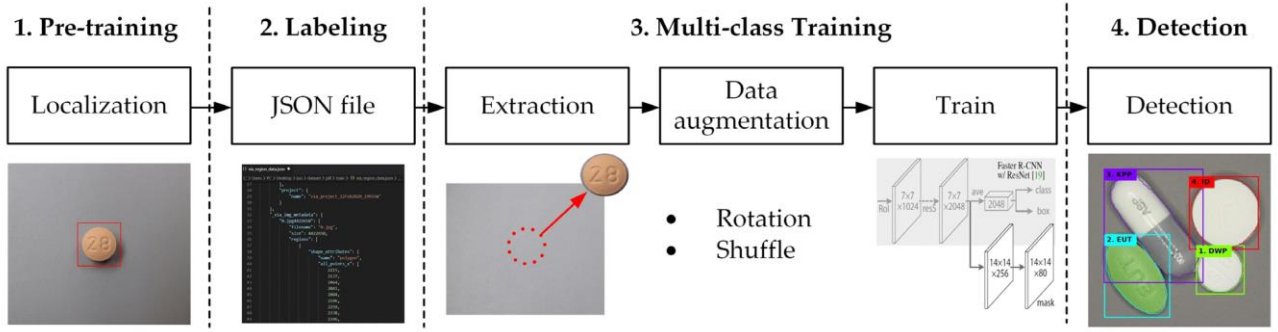
- Detecting and classifying the type of pills based on NDC inside a pouch
- Accurately determining the number of pills
- Detection of broken pills extra pills, or debris inside the pouch

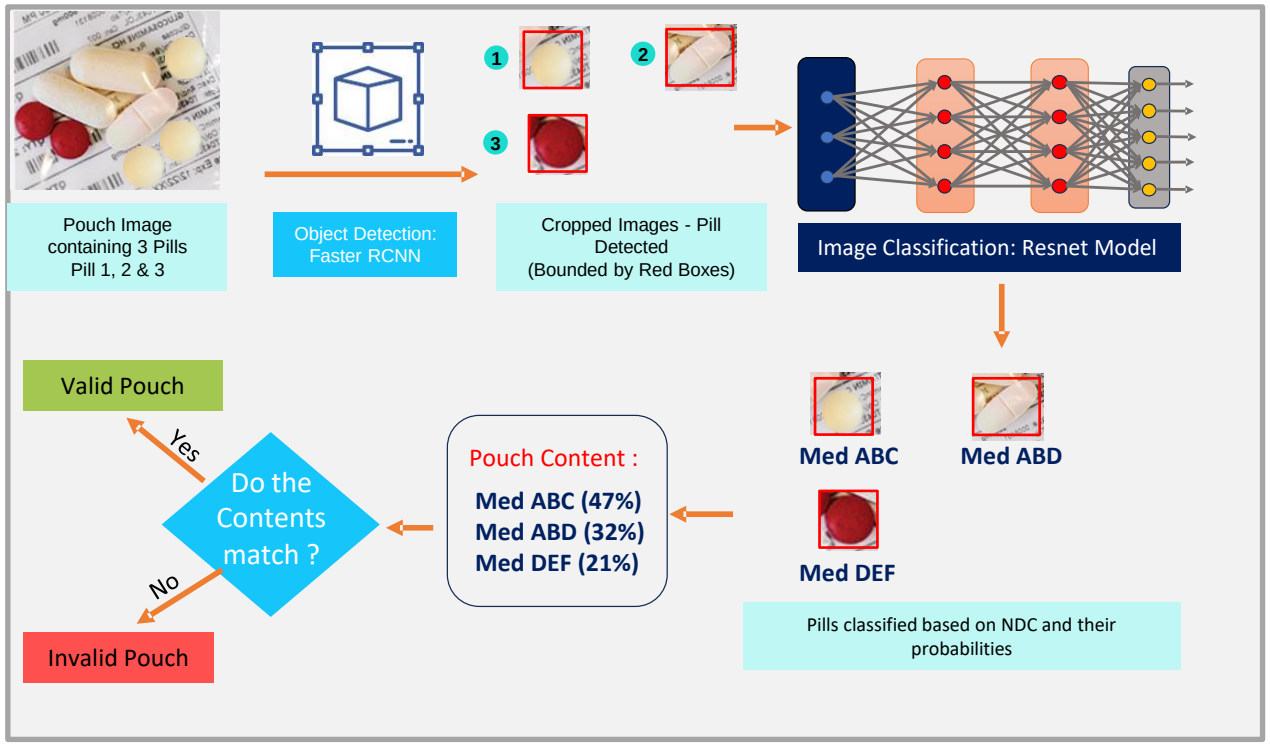
Solution

- Deep-learning based AI systems use pattern matching rather than feature extraction to increase accuracy to **96%+** Deep-learning-based

Benefits

- Reduce the percentage of pouches that the pharmacist manually inspects from 10% of production volume to **4%**.
- For a pharmacy that runs 10k pouches per day, you would reduce the pharmacist burden from 1000 pouches reviewed to 400 pouches reviewed. This improved accuracy could potentially save **~1.5** pharmacist hours per day.
- AI can remove any PHI before sending an image to the algorithm for evaluation





Blister Packaging

Challenges

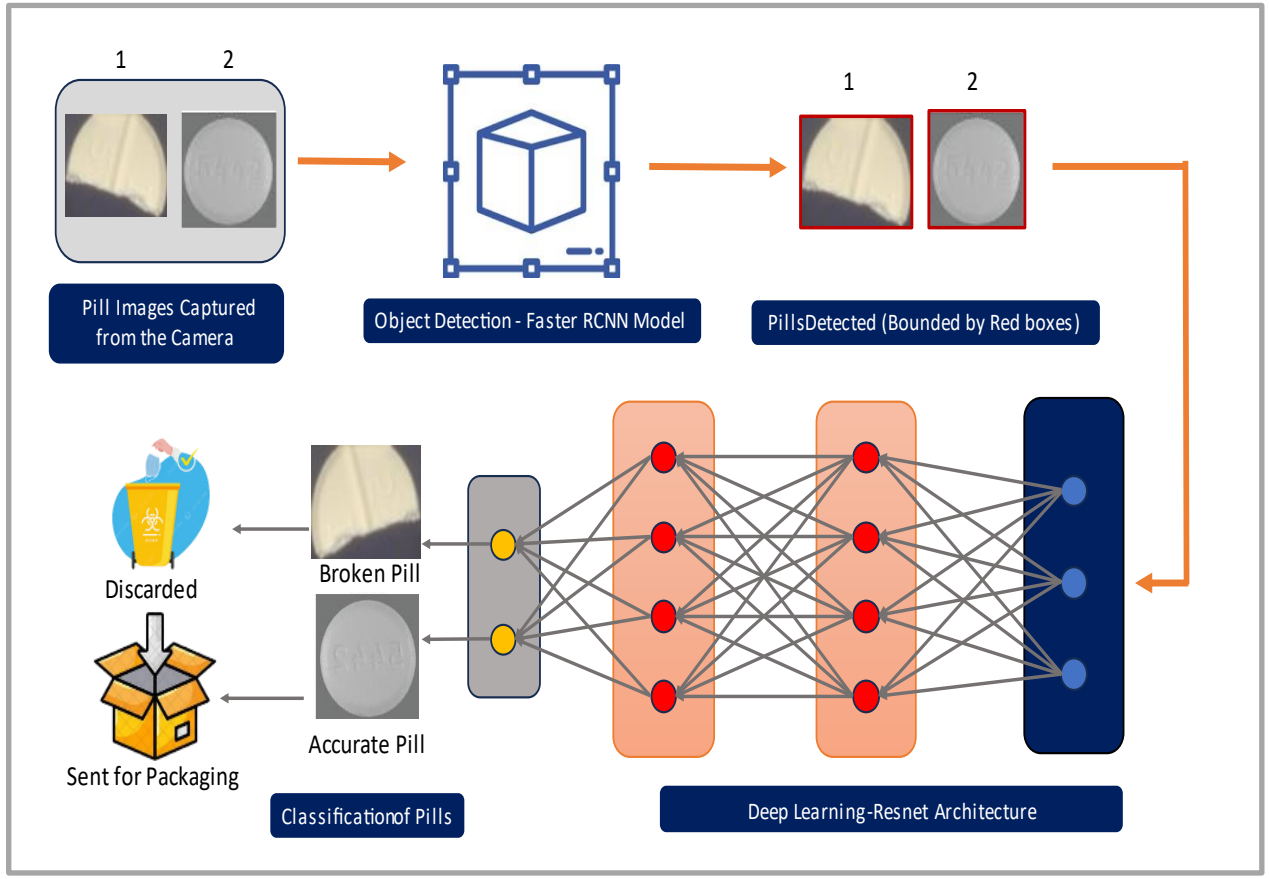
- Detection of broken pills and double pills
- The traditional CV models can have challenges in detecting small chips in pills (broken) and detecting double pills

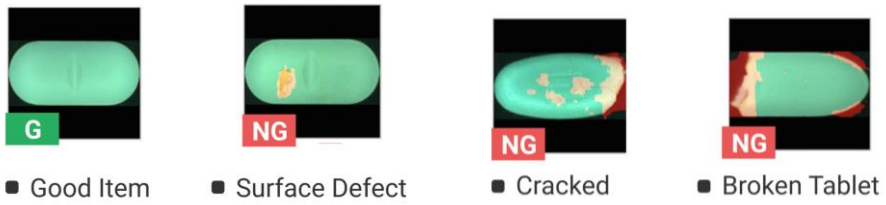
Solution

- **Deep-learning-based Pill Detection and Classification**

Benefits

- increase accuracy in broken and double pill detection from **~80% to 95%+** in early testing.
- Capturing these defects in the packaging process greatly reduces the amount of rework and could reduce pharmacist checking time by **60-70%**.





Future Use Cases – Production QA

Opportunity

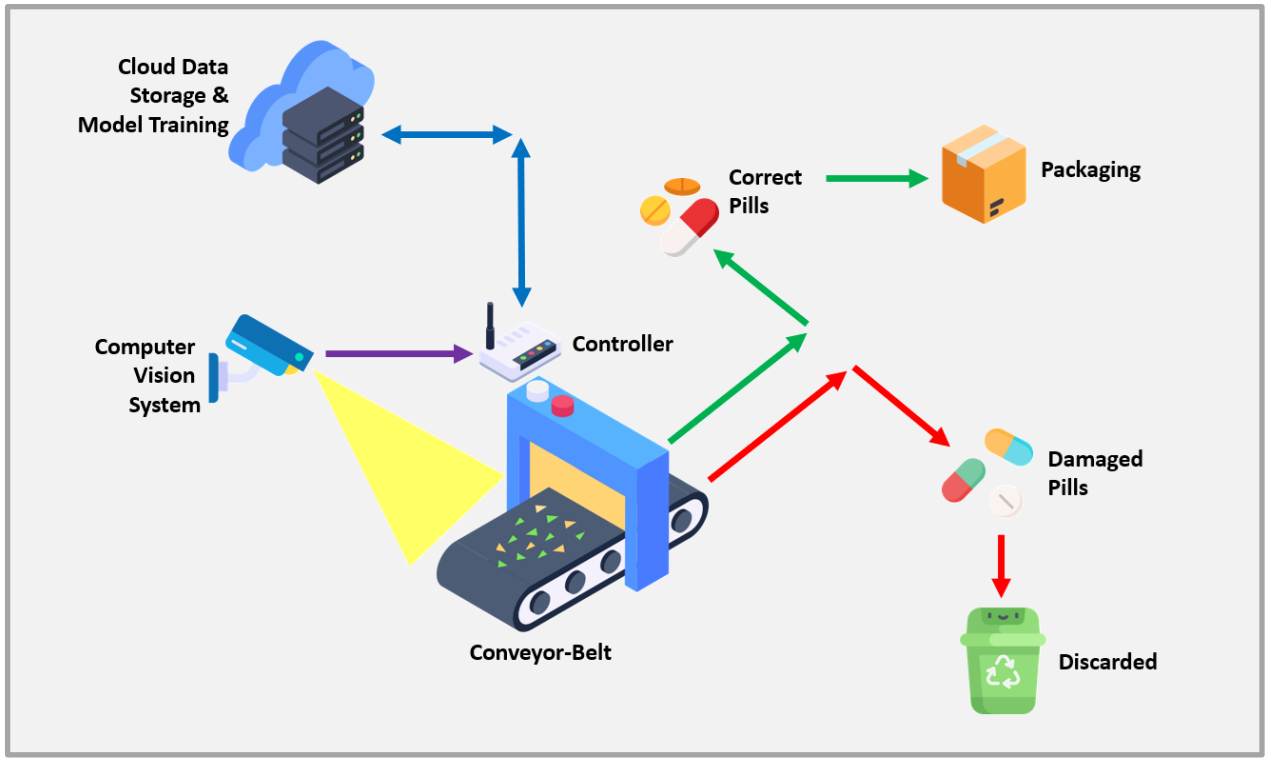
To use AI for a more generalized production quality assurance

This is common in many manufacturing industries and could be applied to pharmacy automation through cameras embedded in each step of the production flow

For example, if a camera was attached to the output port of a pouch packager, the AI algorithm could evaluate the pouch seal, printing, pill count, and debris check as the pouches were being dispensed from the machine.

Benefits

- This process would catch the cascading errors that can happen in pouch packaging before the entire strip or batch is produced



Source: https://www.cognex.com/industries/pharmaceuticals-medical/tablet-capsule-manufacturing/inspection

Anuj Chatterjee

(VP of Data Science, Finarb Analytics Consulting)

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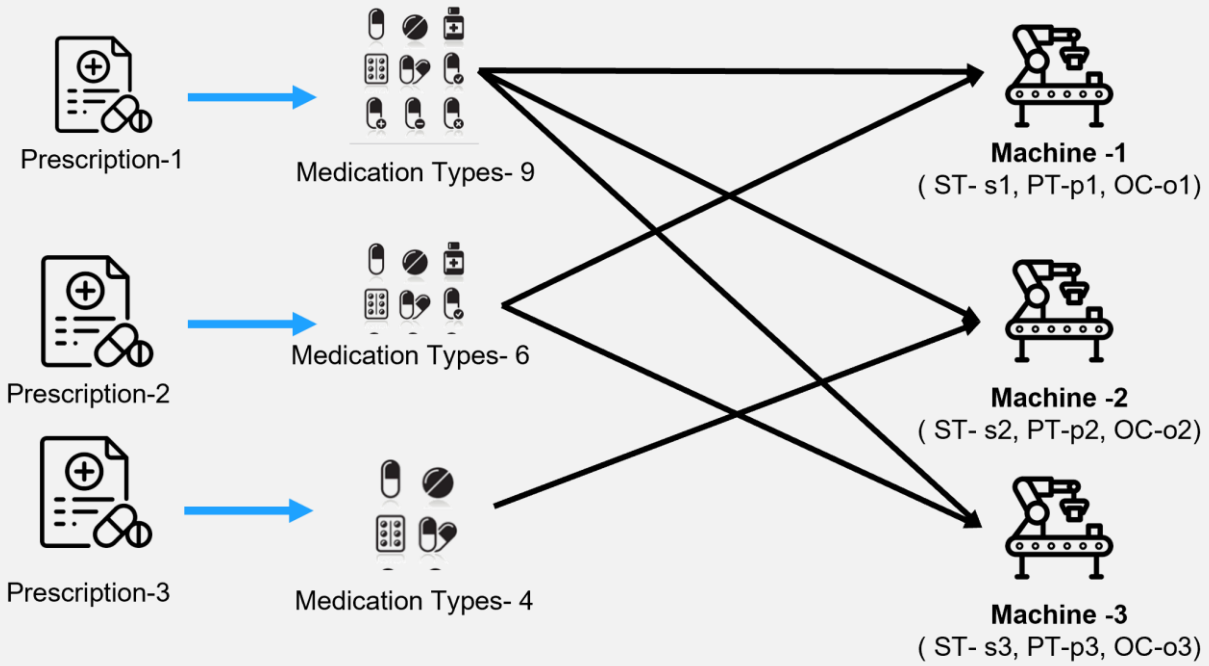
- Using Real World Data to Track adherence and monitoring
- Predictive Maintenance (Error Prediction and RUL prediction)

AI-based routing solutions (1/2)

Scenario



Which medication should go to which machine so that the processing time, collation delay and Make span is minimized??

Now Imagine the Complexity of the Workflow with the following:

- A large pharmacy in the US receives more than 10000 prescriptions in a single day.
- Each prescription has different medications.
- Each medication or job task can be processed through a certain number of machines.
- The number of machines is different, the setup time differs for different machines, and the processing time is different for different orders.
- The cost of operating the machines is also different to process a batch of orders.
- Prescription Complexity- No of doses, dosage form, specific requirement
- Urgency of Prescription- Acute or chronic diseases to be prioritized

Multi-objective optimization problem includes reducing the processing time, reducing the Make span, collation delays, maximizing accuracy, and maximizing resource utilization.

AI CAN OPTIMISE THIS!!!

AI-based routing solutions (2/2)

AI-driven Prescription Analysis	AI algorithms analyze prescription orders, considering various factors like medication characteristics, urgency, and historical data.
Dynamic Machine Allocation:	The AI system dynamically allocates prescriptions to automation machines based on real-time factors such as machine capacity, setup times, and predicted processing efficiency
Real-time Monitoring and Adjustment:	The system continuously monitors the progress of prescription fulfillment in real-time, adjusting assignments to balance the workload and address any delays in real-time

Benefits

- Faster Prescription Fulfilment
- Cost reduction
- Enhanced Resource Utilisation
- Improved Customer Service
- Ability to Handle Fluctuations in Demand

Traditional Workflow vs AI-Optimised Workflow

Parameters	Traditional Workflow	AI-Optimised Workflow
Sorting and Assignment	Manually review Pharmacy and assign them to automation machines based on predetermined schedules	Automatically analyses prescription orders and allocates the task to prescription machines on real-time
Workflow	Static Workflow -> Some machines underutilised, some overutilized	Dynamic Workflow -> Optimal use of machines/resources
Operational Cost	High because of inefficient resource utilization, high wait times and processing times	Low because of optimised resource utilisation, Low wait times and processing times
Customer Satisfaction	Low-> Because of High wait Times	High-> Because of Low/minimal wait Times

Predictive Maintenance of Robo-Pharmacy Machines (1/2)

Predicting the **Remaining Useful Life (RUL)** of the Machines so that one can estimate the number of new machines that need to be installed.

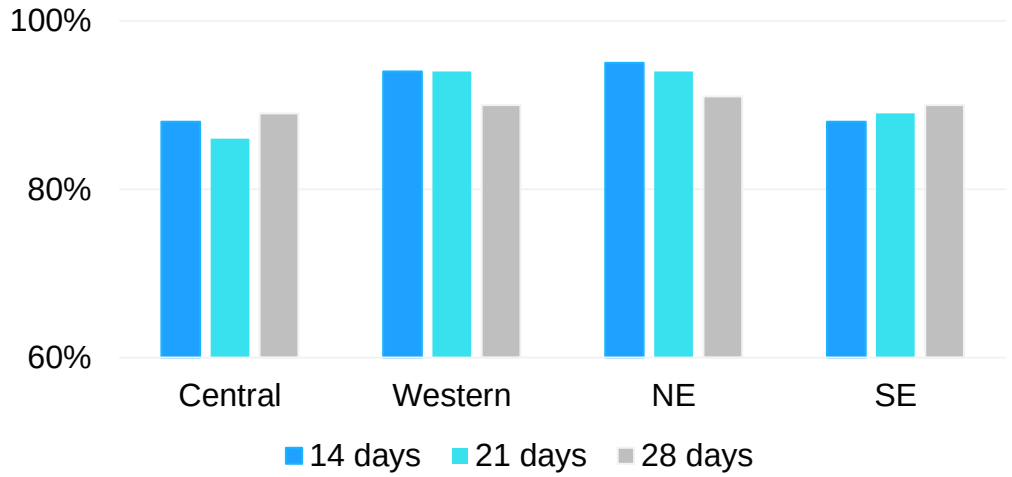
Objective

- Extending equipment lifespan
- Efficient Production Capacity planning

Solution

- We estimated RUL by analyzing health indicators of all Parata's machines (based on machine historical performance, sensor readings, and maintenance records), classified different degradation stages, and predicted RUL
- We used other deep learning approaches for optimizing feature learning and RUL inference

COVERAGE OF TIMELINE OF EQUIPMENT FAILURE DETECTION ACROSS CLIENT FACTORY LOCATIONS – GINI INDEX OF OUR MODELS WAS 0.6
(Gini index above 0.5 is considered 'Good')



>85% accuracy across regions to predict useful life

>20% reduction in cases

Predictive Maintenance of Robo-Pharmacy Machines (2/2)

Error Prediction so that mitigation measures are taken before an actual breakdown

Objective

- Reduce machine downtime across all of Parata's plants and minimize production losses
- Minimize adverse event of breakdown - Fixing production lines post-breakdown is more cost-intensive than conducting preventive maintenance ahead of the breakdown cost-intensive
- Maintain quality and performance of their manufacturing equipment
- Reactive maintenance can lead to high repair and maintenance costs

Solution

- Create Time series data on error types
- Use IOT data as exogenous variables
- Incorporate case history, resolution history, FSE field notes
- LSTM networks were deployed to learn sequential features from raw sensory data.
- Use ensemble distance-based time series classification

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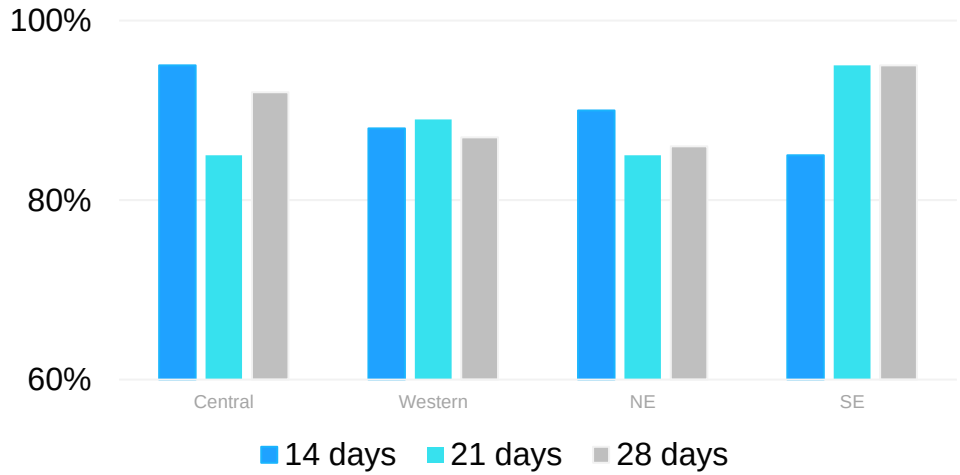

Error prediction accuracy of **>90%**

Targeted and planned inspections and repairs

Using Real World Data to Track adherence and monitoring (1/2)

PHARMACIES

About 40 percent of seniors take five or more prescription medications a day, but over 55 percent of seniors do not properly take these medications, according to an American Diabetes Association report.

Solution :

- Adherence Packaging of Medications (Name, Day, Time)
- Pharmacies can collect Data
- Build Adherence Models and Identify Patients with High Risk of Non-Adherence

Challenge:

- **Accurate and real-time monitoring of Patient Adherence**

PATIENT SUPPORT SERVICE ORGANISATIONS

A large chunk of patients do not conform to their prescribed medications, causing problems across the entire value chain of prescription medicine, adversely affecting patient health, but also payers and drug manufacturers

Solution :

- We determined medication adherence in terms of Proportion of Days Covered (PDC)
- Data: Combined RWD with medication refill data
- Feature Engineering
- Advanced NLP techniques to handle survey responses.
- ML model for risk stratification of patients with interventions using explainable AI

Challenge:

- **Reliance on Patient Self-Reporting**

MEDICATION DISPENSING ROBOTS

Even though adherence packaging is done and support service organizations fill surveys from patients, There is a lot of scope for accurate medication adherence among patients

Solution :

- Real-time tracking
- Connectivity with Mobile Apps
- Convenient and Accessible

Benefits:

- Timely Notifications for Medication intake – Patient, Other Close members, Caregiver
- Accurate Adherence monitoring
- Insights for Patient Support Service Organisations- Use RWD for building Adherence Models

Using Real World Data to Track adherence and monitoring (2/2)

MEDICATION DISPENSING ROBOTS

Features

- Deliver medication on time, as scheduled
- Record when doses are taken or missed
- Alert your care circle when doses are missed
- Mobile Alerts
- Monitor medication adherence

- Medication reminders
- Daily check ins
- Dosage control
- Two-way video calls/chats
- Dashboard
- Medicine Cabinet
- Pria Contacts
- Reports

Adam Docrat

(Head of IT- Aster Retail GCC, Aster Pharmacy)

- AI in Inventory Management
- AI in Route Planning- Logistics
- Future of Pharmacy Automation

What is Pharmacy Automation?

- Definition and explanation of Pharmacy Automation
- The role of AI and automation in the pharmacy industry
- The impact of Pharmacy Automation on productivity and efficiency

The Need for Pharmacy Automation

- The challenges faced by the pharmacy industry
- How Pharmacy Automation addresses these challenges
- Case study: A pharmacy that benefited from automation
  - Speed to dispense
  - Automated Approvals
  - Dispensing Accuracy
  - Serialization & Batch Tracking

AI in Inventory Management

- How machine learning models optimize inventory levels
- The benefits of machine learning in inventory management
- Case study: A pharmaceutical company that optimized waste with machine learning
- Batch Tracking & Serialization
- InterBranch Automated Transfers
- Promotion Management
- Zero Sales History & Seasonality

Machine Learning for Inventory Optimization

- The challenges faced by the pharmacy industry
- How Pharmacy Automation addresses these challenges
- Case study: A pharmacy that benefited from automation
  - Speed to dispense
  - Automated Approvals
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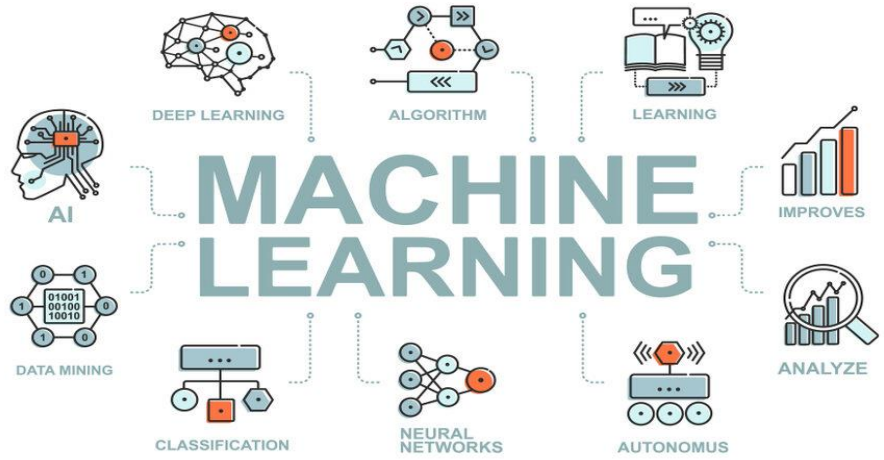

AI in Route Planning

- How AI improves route planning in the pharmacy industry
- The benefits of AI in route planning
- Case study: An Organisation that improved its delivery efficiency with AI
    - Route Planning
    - Vehicle Optimization
    - Sustainability & Carbon Footprint
    - Delivery Schedules & Replenishment

The Future of Pharmacy Automation

- The potential of AI and automation in the pharmacy industry
- The challenges and opportunities for Pharmacy Automation
- Final thoughts on the impact of Pharmacy Automation on productivity and efficiency

Audience Q&A

FINARB ANALYTICS CONSULTING

Finarb is a leading provider of Advanced AI ML and Data Analytics solutions. We partner with our clients on their business transformation journey enabled by AI starting from problem discovery – strategy & consulting – rapid prototyping & MVP – build – deploy – manage – operate. Our vision is to democratize AI and enable large, mid-sized and SMB organizations take advantage of the power of AI for sustained growth, competitive advantage and be resilient enterprise of future!

80% of our clients are the Forbes 1000 enterprises with 78% of them being our long term partners. We are recognized for our high client satisfaction score of 4.9/5. Our AI models are pioneering in their own right with 4 patents filed so far.

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