# AI ON THE SHOP FLOOR

# A GUIDE FOR MANUFACTURING PROFESSIONALS

Powered by the Accella MFG Bot™

Accella AI

We Make Smart Manufacturing a Reality

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If you work in production, quality, or operations and are evaluating AI for visual inspection, inbound/outbound verification, or predictive maintenance on the shop floor, this eBook is for you.

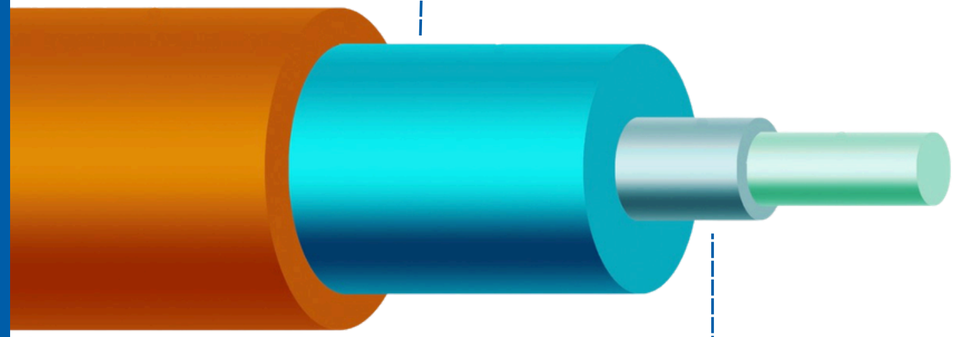
It provides explanations without jargon and highlights where, how, and why AI can support you from the perspective of experienced practitioners.

# AI IS CONFUSING HERE'S WHY

- Too much tech jargon
- Too much information you don't need
- Too little information relevant to you
- Applications and their value in manufacturing are unclear
- Too much hype
- Too little information about implementation

# DEFINITIONS OF KEY TERMS

These basic terms are relevant to manufacturers but are often used inter-changeably, causing confusion. The main insight is that these terms are related and nested, like layers in a cable:
AI is the broad outer field, machine learning is a subset of AI, and deep learning is a subset of machine learning. Generative AI sits at the core as one way deep-learning models are used to create new content.



### MACHINE LEARNING (ML)

A subset of AI that uses algorithms to analyze data, as well as learn to make predictions and decisions without being explicitly programmed.

### GENERATIVE AI (Gen AI)

A branch of AI and a subset of DL that creates models capable of generating new content e.g., images, videos, text, and code

### ARTIFICIAL INTELLIGENCE (AI)

The ability of machines to perform tasks that typically require human intelligence, e.g. understanding language, recognizing images, making decisions.

### DEEP LEARNING (DL)

A subset of ML that uses neural networks to mimic the learning process of the human brain. DL needs a larger amount of data but can learn from the environment and past mistakes.

# MORE USEFUL TERMS

Implementing AI these terms you are likely to come across

Here are a few additional terms that are important to know when implementing AI on the manufacturing shop floor.
More useful definitions can be found in our Glossary on the Accella AI website

## DIGITAL TWIN

A virtual representation of the real-world plant that is continuously updated with data from sensors, devices, and other sources.
*Applications:*

- Real-time monitoring, analysis, and simulation offering insights into the performance, status, and behavior of the plant.
- Support process optimization, predict maintenance needs, and improve overall efficiency.

## TRAINING DATA

A subset of a dataset that is used to train a machine learning model. During the training process, the model learns patterns, relationships, and features from the training data. The representativeness and quality of the training data significantly impact the model's performance and generalizability.
*Applications:*

- Enable the model to make predictions on new, unseen data.

## VALIDATION DATA

A portion of the data that is used to fine-tune and evaluate the performance of an ML model.
*Applications:*

- Serves as an independent dataset to assess how well the model generalizes to unseen data.
- Helps prevent common issues like overfitting by providing a measure of the model's performance on data it hasn't seen before.

## UNSUPERVISED LEARNING

In unsupervised learning, an ML model is trained on unlabeled data, meaning there are no predefined output labels.
*Applications:*

- Uncover patterns, relationships, or structures within the data without explicit guidance on what the model should learn.

## SUPERVISED LEARNING

In supervised learning, an ML model is trained on a labeled dataset, which means that each input in the training data is associated with a corresponding target or output.
*Applications:*

- Learn the relationship between the input data and the desired output by generalizing from the labeled examples.

## EDGE COMPUTING

In edge computing, data is processed close to where it is generated, e.g., on a local device instead of being sent to a distant server or cloud.
*Applications*:

- Enable real-time monitoring and control.
- Reduce bandwidth usage and keep critical functions running smoothly even when network connections are slow or unavailable.

# AI APPLICATIONS IN MANUFACTURING

## VISUAL INSPECTION

**WHAT**

- AI excels at defect detection and categorization
- Can be trained to differentiate between OK and NOK products by showing examples
- When trained, can autonomously decide whether a product is OK or defective, and if so, categorize the defect

**WHY**

- Highly accurate (>99.9%)
- Consistent across operators, lines, shifts, and plants
- Reliable 24/7
- Performs at high throughput (~ 1,500 products per minute), allowing inspection of every product, not just samples
- Excels at highly repetitive tasks and frees up humans for more value-added tasks
- Cost-effective and typically breaks even within months

## PREDICTIVE MAINTENANCE

- Quickly analyzes large amounts of data and finds patterns that indicate emerging issues
- Detects problems before they cause unplanned downtime
- Allows streamlining of tasks such as creating maintenance schedules
- Can delay replacement of parts until necessary, rather than based on a fixed schedule
- Can extend equipment life

- Detects complex patterns across many signals that humans and simple thresholds miss
- Scales to monitor large fleets of assets without adding headcount
- Adapts quickly to changing operating conditions
- Supports condition-based maintenance instead of purely time-based schedules
- Helps prioritize limited maintenance resources based on risk
- Reduces unplanned downtime, improving overall equipment effectiveness

# AI APPLICATIONS IN MANUFACTURING

## SHIPMENT VERIFICATION

**WHAT**

- Automatically captures images of pallets and loads as they pass through a dock checkpoint
- Identifies packaging types and counts visible units, comparing them to expected orders or receipts
- Checks presence and legibility of key labels and barcodes
- Flags mismatches, missing items, or visible damage
- Logs each load with visual evidence and pass/fail results for traceability

**WHY**

- Keeps up with high-volume, fast-paced dock operations
- Applies the same checks consistently across shifts, docks, and sites
- Reduces manual counting and paperwork so staff can focus on other tasks
- Provides objective evidence when customers or carriers question what was shipped or received
- Helps reduce chargebacks, returns, and re-shipments caused by shipping and receiving errors
- Improves inventory accuracy and confidence in upstream and downstream planning data

## OTHER AI SHOP FLOOR APPLICATIONS

In addition to quality and shipment verification and predictive maintenance, the same AI capabilities can be extended to other use cases:

**Predictive Analytics**

The use of historical and current data, statistical methods, and machine learning to estimate the likelihood of future outcomes.
Applications:

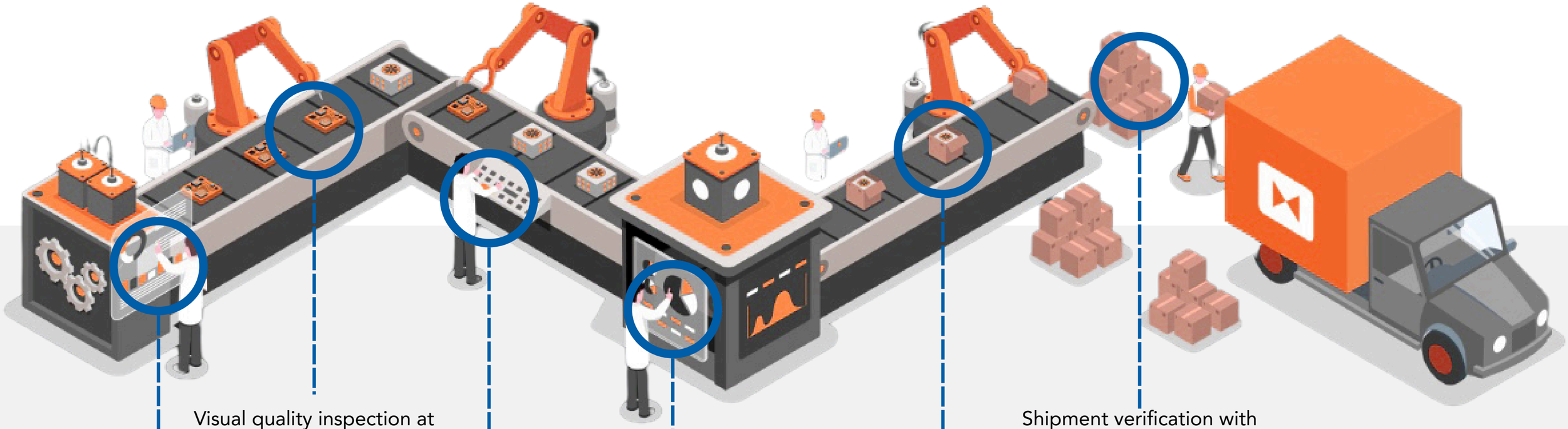
- Predict the physical characteristics of components based on input materials and external factors, e.g., temperature
- Optimize processes that couldn’t previously be optimized in an economically feasible way

**Simplification of Human-Machine Interfaces**

The use of AI to reduce the complexity of machine setup, making the process faster and less error-prone.
Applications:

- Reduce the setup time of complex machinery, e.g., extruders, to make smaller runs economically feasible
- Reduce error rates and reliance on highly trained personnel

# AI ON THE SHOP FLOOR



HMI simplification based on the Accella MFG Bot™ AI helps set up and operate complex machinery

Visual quality inspection at critical stages during production with the Accella Quality Box™

Predictive maintenance with Accella Predict Core™ reduces unplanned downtime and enables process optimization

Predictive analytics using Accella Predict Core™ helps optimize accuracy and product characteristics

Quality inspection of the final product ensures that no defective products are shipped to the customer

Shipment verification with Accella Dock Check™ ensures the correct products are shipped to the customer

# USE CASE

## VISUAL INSPECTION OF WOOD BOARD SURFACES

Customer: Leading European Construction Company

Solution: Accella Quality Box™

## CUSTOMER NEED

- Improve detection of surface defects on wood boards at line speed
- Sort and route boards by quality grade to minimize rework and waste
- Reduce reliance on manual visual inspection in challenging lighting conditions

## CHALLENGES

Manual inspection struggled with both the high throughput of boards and the natural variability of wood. Knots, grain, and color differences made it hard to apply consistent quality criteria, especially under the difficult lighting conditions in the sawmill.
As visual fatigue set in, some defective boards were missed, while others were unnecessarily downgraded, creating rework and scrap downstream.

## SOLUTION

An AI-based visual inspection system was installed above the production line. A camera captures each board as it passes, and a trained model analyzes the surface to generate a defect score. The higher the score, the lower the board quality.
A cut-off defect score is defined by the customer, and products that do not meet the requirement are used in less demanding applications or discarded.

1. More consistent detection and grading of board quality
2. Better use of lower-quality boards by routing them to appropriate applications instead of scrapping them
3. Reduced manual inspection workload while maintaining line speed


# USE CASE

## OUTBOUND PALLET VERIFICATION

Customer: Large US Manufacturer of Flooring Solutions

Solution: Accella Dock Check ™

## CUSTOMER NEED

- Verify pallets and shipments automatically at the dock
- Reduce shipping errors and chargebacks
- Provide better documentation of what left and what arrived

## CHALLENGES

The customer needed a way to verify pallets and shipments at the dock without slowing truck turns. Manual checklists and barcode-only checks were inconsistent, error-prone, and labor-intensive. In addition, the jobs for manual scanning personnel have high turnover and are very difficult to fill.

## SOLUTION

A Dock Check™ station equipped with an industrial camera and AI models trained to count boxes and read barcodes was deployed at the customer's dock. As pallets pass through, the system captures images, verifies product type, counts visible units, and checks labels to verify that the correct number and type of products are shipped. Results are shown to the operator and logged automatically.

1. Box count and product type is verified for each shipmnt even if stacks are uneven and/or not perfectly aligned
2. Reduces the need for manual scanning, freeing up personnel for other tasks
3. Better traceability when customers or carriers raise questions about what was shipped or received

# USE CASE

## PREDICTIVE MAINTENANCE OF PUMPS

Customer: Leading Manufacturer of Primary Batteries

Solution: Accella Predict Core™

## CUSTOMER NEED

- Better control of maintenance requirements for critical pumps
- Reduce unplanned downtime and process interruptions
- Develop a holistic understanding of all factors impacting battery quality

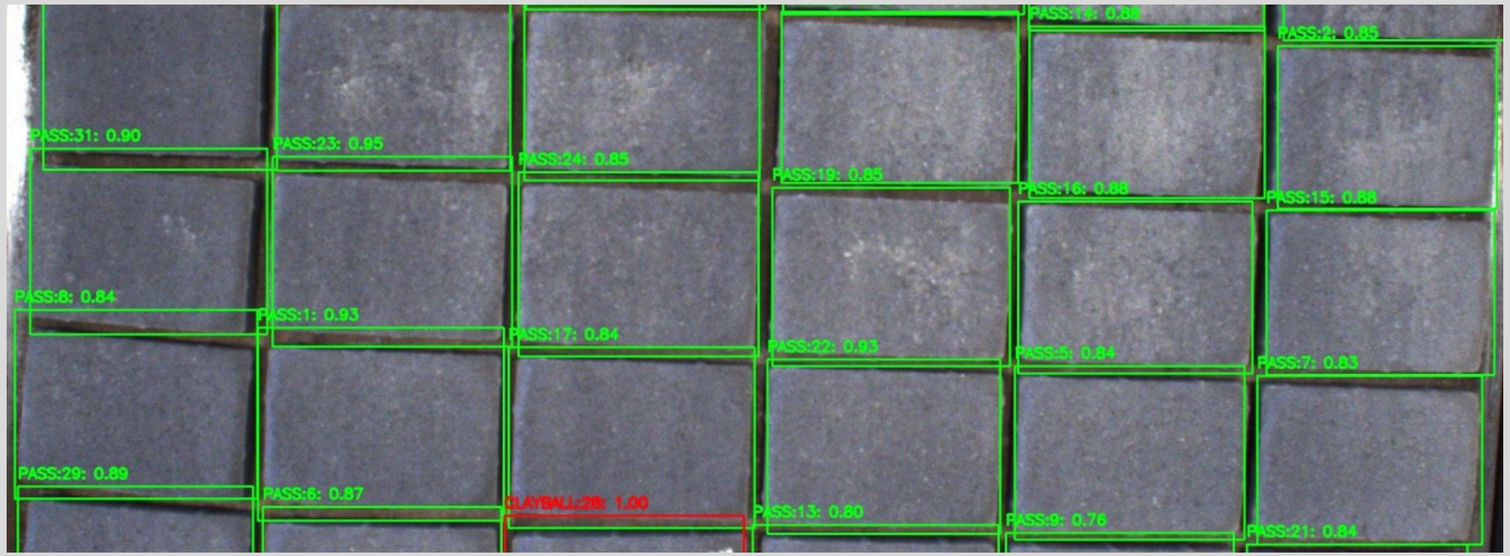
## CHALLENGES

The customer operates a large number of pumps that are critical to production. Traditional time-based maintenance did not reflect the actual condition of each pump: some were replaced too early, while others failed unexpectedly between scheduled services. They also want to develop a robust maintenance schedule that optimizes maintenance activities during planned downtime.

## SOLUTION

An AI model was trained to link and analyze data from both quality control and maintenance systems to create a more complete picture of pump health. The model learned to recognize patterns that indicate an increasing risk of failure and provides a health score for each pump. Pumps with elevated failure risk are prioritized for inspection or replacement during planned maintenance windows, while low-risk pumps can remain in service longer.

1. Improved targeting of maintenance activities, focusing effort on the pumps with the highest risk of failure
2. Fewer unexpected pump failures and less unplanned line downtime
3. Improved overall equipment efficiency




# USE CASE

## DEFECT DETECTION ON PAVERS

Customer: Manufacturer of Concrete Pavers

Solution: Accella Quality Box™

## CUSTOMER NEED

- Detect defective pavers before they are palletized and shipped to the customer
- Identify different defect categories to inform troubleshooting
- Ensure consistency across lines

## CHALLENGES

Defective pavers are identified by shop floor personnel and replaced with good products. The process is labor-intensive and very inconsistent across operators, shifts, lines, and plants. Paver boards come in several different configurations that the solution needs to detect automatically. AI-based QC needs to be performed in under 7 seconds per board.

## SOLUTION

An AI-based visual inspection model first recognizes the pavers on each board and then assesses every paver individually for different defect categories. The results are displayed on an operator screen so defective pavers can be identified and replaced quickly. Automated removal using robotic systems can be added later if desired.

1. Detection of defective pavers with high accuracy
2. Each board can be analyzed in under one second
3. Defect detection accuracy is independent of shift, operator, line and plant and highly consistent

# USE CASE

## PREDICTIVE ANALYTICS OF SLURRY VISCOSITY

Customer: Leading Manufacturer of Primary Batteries

Solution: Accella Predict Core

## CUSTOMER NEED

- Predict whether slurry viscosity is within the required range before the start of production
- Adjust process parameters if the viscosity is out of bounds.
- Reduce waste caused by out-of-spec slurry

## CHALLENGES

Traditionally, the viscosity of a batch of battery slurry is measured after production. If the slurry does not meet the required specifications, the batch has to be discarded. The customer wanted a way to determine in advance whether a batch will meet specs and, if not, to receive concrete guidance on how to adjust the process or slurry recipe to compensate.

## SOLUTION

An AI model using roughly two dozen production factors was trained on thousands of historical batches. Based on these inputs, the model learned to predict slurry viscosity and can now be used to check slurry characteristics before a batch is produced. When it predicts that viscosity will be out of range, the system recommends adjustments so operators can correct issues ahead of time.

1. Reduced production of bad batches of batteries, leading to less waste
2. Provides actionable recommendations to operator when viscosity is predicted to be out of spec
3. Lower production costs driven by less scrap and more stable slurry quality

# USE CASE

## HMI SIMPLIFICATION OF EXTRUDER INTERFACE

Customer: Leading Manufacturer of Extruders

Solution: Accella MFG Bot-enabled

## CUSTOMER NEED

- Simplify and shorten setup of a new product on an extruder
- Reduce dependency on a few highly-trained operators
- Make shorter production runs economically feasible

## CHALLENGES

The extruder was time-consuming and complex to set up and operate, with setup times of 8 to 16 hours for a new product. Only a small group of highly trained operators could perform the task, creating bottlenecks, especially during night shifts. Long setup times also made manufacturing new products, especially short production runs, cost-prohibitive.

## SOLUTION

An AI model was trained to assist the operator with setup. Instead of manually adjusting over 100 machine parameters, the operator enters key product characteristics and the AI model proposes suitable parameter values for the extruder. Operators can review and confirm the settings, reducing effort while keeping control of the process.

1. Setup time reduced by more than 60 percent, enabling much faster changeovers
2. Reduced dependency on a few key staff members, easing staffing constraints and night-shift bottlenecks
3. Short production runs become economically feasible due to lower setup overhead

# IMPLEMENTATION

## DATA, PEOPLE, AND TECHNOLOGY TO CONSIDER BEFORE STARTING WITH AI

### DATA

Getting the right data in the right quality is the first hurdle in AI projects.

- Which data do we need for AI on the shop floor, and do we already collect it?
- Where and how will we store, curate, and access it for AI?

**Tip**: Decide early on storage (cloud or on-prem) and what sensors, cameras, and computers are needed to acquire the data.

### PEOPLE

Change management often creates the most difficult and least predictable challenges.

- How will AI change roles, workloads, and required skills?
- Who needs to be informed and involved early to avoid surprises?

**Tip**: Treat change management as its own workstream, not an afterthought.

### TECHNOLOGY

Infrastructure and integration decisions can speed up AI implementation—or slow it down.

- How will AI connect to PLCs, MES, SCADA, and other existing systems?
- Do we have enough compute, storage, and network capacity, and a clear security approach?

**Tip**: Address constraints around operating systems, networking, and security early to avoid late surprises during rollout.

Take our self-assessment to find out how ready you are for AI.
Want to go deeper? See our blogs covering topics related to AI implementations on the shopfloor

## About Accella AI

Founded in 2019, Accella AI provides AI-enabled solutions for manufacturing companies, industrials, and IoT companies that allow them to reduce costs, improve quality, and better utilize existing T

The Accella MFG Bot™ platform enables AI-based solutions for quality inspection, shipment verification, predictive maintenance and analytics, and, where needed, simplification of complex human-machine interfaces.quickly and with existing personnel.

Make Smart Manufacturing a reality with the Accella AI Bot!

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