Smarter education for smarter planet

IBM Innovation Centre for Education

Welcome to:

Machine Learning in Transportation and Logistics

Unit objectives

After completing this unit, you should be able to:

- Learn about applications of machine learning and artificial intelligence in transportation
- Understand the application of AI in aviation and public transportation
- Gain knowledge on artificial intelligence use cases in logistics
- Learn about ml powered customer services in logistics and transportation
- Understand the limitations of AI techniques in transportation

Introduction

- Artificial Intelligence (AI) has an extremely key role in the logistics field.
- Artificial intelligence comes with computing methods that help pick large amounts of data from the logistics and supply chain.
- The system-based architecture of the sector creates a powerful foundation for AI implementation and optimizing in logistics, reinforcing the biological elements of tightly organized global supply chains.
- AI extends beyond product ubiquity and into commercial ventures focused on consumers.
- Nevertheless, as many logistics companies around the world are adopting technological change, from conventional resource management systems to developed analytics, enhanced hardware and software automation and robotics, and digital technology.
- AI gives organizations the opportunity to automate network coherence with level of productivity that individual thought cannot accomplish.

Applications of ML and artificial intelligence in transportation

- The ML travel programs were implemented in a variety of forms. Among them, for instance:
  - Use machine learning techniques in strategic choice-making and management.
  - AI technologies are also discussed with a view to improving public transport.
  - Connected and autonomous cars are the next promising AI technology in transport, which tries to increase efficiency by limiting the amount of road disaster.

Applications of machine learning in transport

- AI technique can be viewed as an intelligent remedy for these complicated systems that traditional methods cannot be used to manage.
- A lot of ai methods are also used in transportation such as ANNs.
- Many travel problems lead to an issue of segmentation concerning custom methodologies to make mathematical data analysis easy to solve.
- The aim of organizing is to define the needs of the society and agree on the good method to satisfy this supply while taking advantage of transport's cultural, ecological and financial effects.
- Few applications of machine learning in transport are:
  - Incident detection.
  - Predictive models.

Incident detection

- There have been many efforts to classify the date, location, and extent of an accident and assist traffic management in reducing congestion.
- Using statistical techniques such as the California algorithm, event detection algorithms were first introduced.
- Algorithms have been developed for neural network approaches.
- To detect an incident on an autobahn, a neural network detection algorithm has been tested.

Predictive models (1 of 2)

- Smart Transport Services (STS) progressive growth has enhanced the need to incorporate sophisticated traffic data prediction methods.

- Sophisticated passenger intelligence structures, sophisticated traffic control systems, sophisticated public transport systems and business automobile services, play a key role in the reliability of ITS components historical data.

- An element-oriented model of a recurring time-lag system (TLRN) neural network has been developed.

- In the past, research has concentrated on short-term stream forecasting through the use of simple feed forward computer program.

Predictive models (2 of 2)

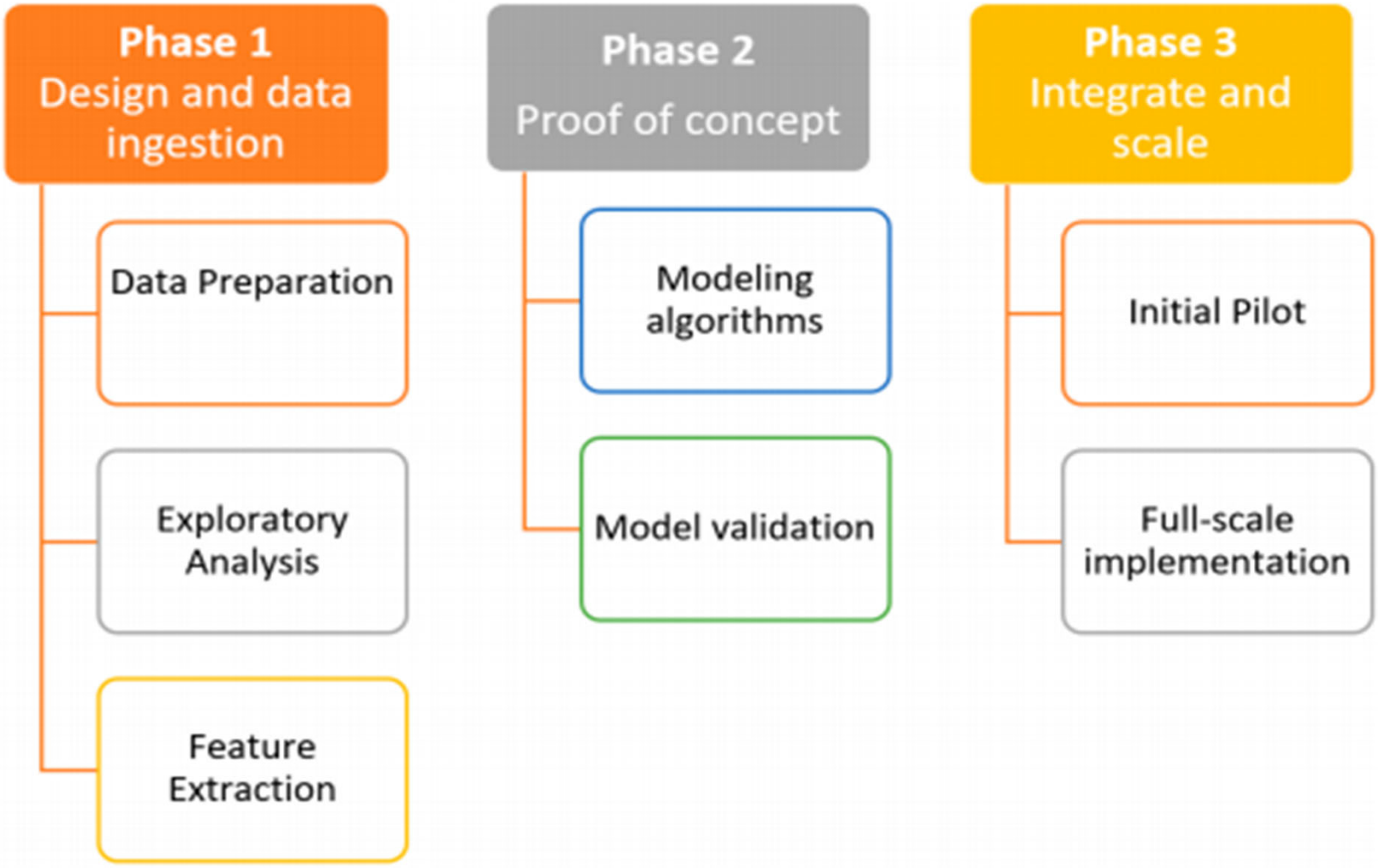

Figure: Three phases approach to develop advanced predictive model

Source: Ernst & Young

Application of AI in aviation and public transportation

- Aviation.
- Shared mobility.
- Buses.
- Intelligent urban mobility.
- Autonomous vehicle.

Aviation

- To control the flight trip more efficiently, AI has been acknowledged.
- A program called (PLADS) was developed in to retrieve and modify evidence to back up virtual system and SA optimization structures from high density aviation papers.
- The safety of the aircraft was measured by testing the engine on board utilizing the Probabilistic Neural Network (PNN).

Shared mobility

- ICT-enabled platforms for exchanges of goods and services drawing on non-market logics such as:
  - Sharing.
  - Lending.
  - Gifting.
  - Swapping.
  - Market logic.
    - Renting.
    - Selling.

- The evolving digital revolution has a strong interest in building innovation structures to create current distributed transportation solutions to establish a reliable transport network.

- For instance, by recommending user location based on travel background of the user, the uber provided customized rider experience.

Buses

- ANNs is easy to use by forecasting bus arrival times to reduce the waiting time for passengers.
- Usage of buses was also applied to automatic bus layout. With a strong dual-mode architecture.
- The innovative on-production bus services that run with flexible schedules and routes are another example in the AI developments in demand sensitive public transportation.
- These services are intended to provide taxi's door-to-door convenience at a fraction of their cost along with the bus model's efficiency.
- An Automatic Vehicle Location (AVL) system aimed at improving the performance of public transport activities, retaining operational controls and enhancing the overall quality of public transport services.

Intelligent urban mobility

- The upcoming sight of smart social flexibility is strategic, real-time information-based decision-making and network management through efficient use of infrastructure.

- The world has recently been at the cusp of creating Autonomous Vehicles (AVs), i.e. vehicles that can travel without a human driver's assistance and guidance.

Autonomous vehicles

- Autonomous Vehicles (AV) depend on AI operating system based on deep learning.

- This method works by educating the car how to ride while retaining stable journey times, speed limits, and regulation etc., AVs are expected to have a significant shift in the way transport structures are worked worldwide and their effect on road protection and congestion has been projected to some degree along with their ability to change transport conduct.

- An international investigation into another dimension of what renders the smart intellectual cars more attractive to travellers was as follows:
  - Self-healing: Cars can detect and correct the fault on their own.
  - Self-socialization: The ability of a vehicle to communicate in natural language with the local environment, other vehicles and people. Self-learning: The car uses its own habits, drivers, passengers, and the world around it.
  - Self driving: The vehicle's ability to drive itself in a regulated setting that is fundamentally limited.
  - Self-configuration: Increasing flexibility requires electronic data to define the vehicle's desired experience and customization.
  - Self-integration: The ability to link to other transport systems such as any other intelligent transport network.

Autonomous transportation

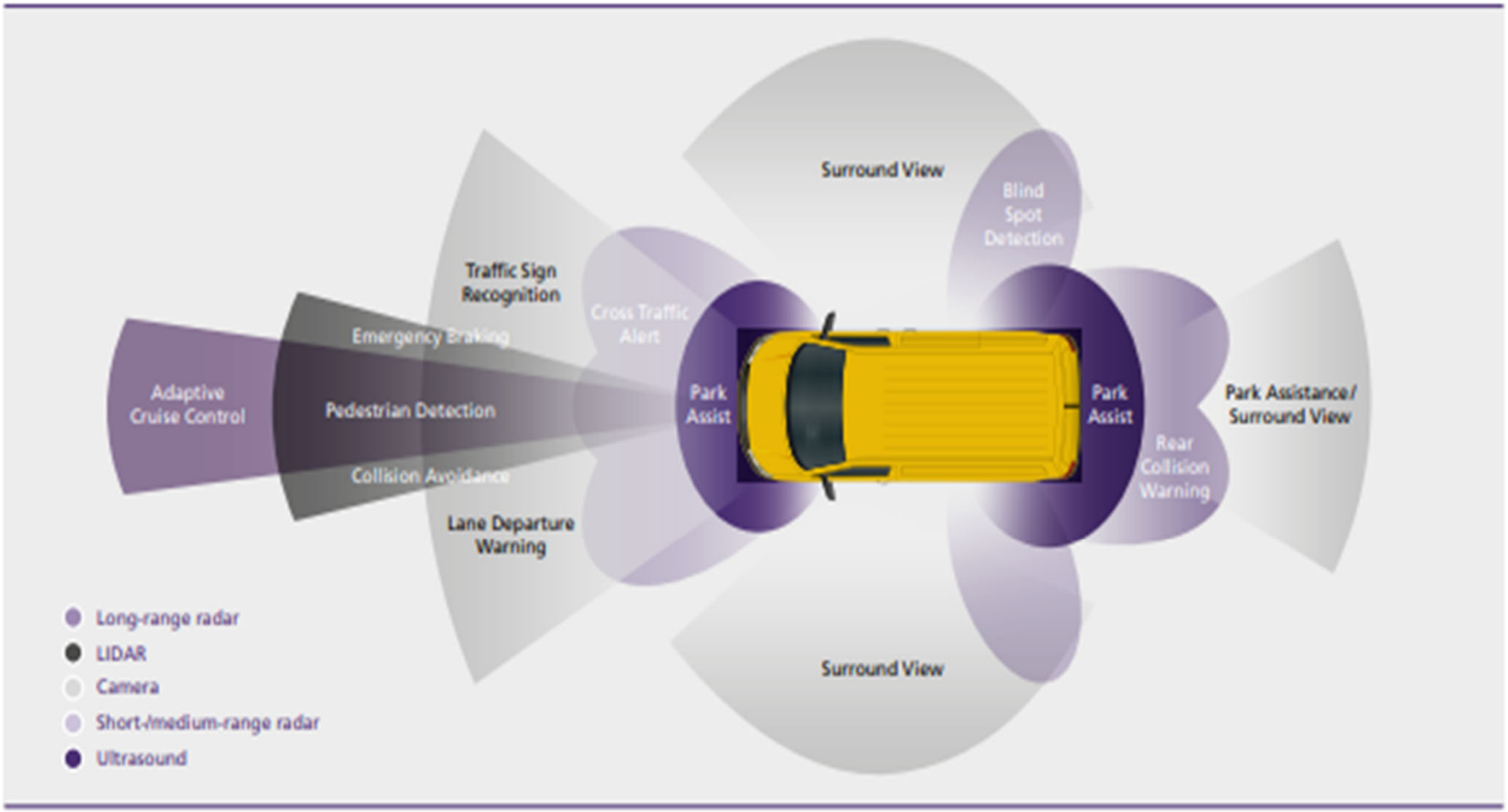

Figure: Autonomous transportation

Source: Ernst & Young

Artificial intelligence use cases in logistics

- Back office AI.
- Cognitive customs.
- Predictive logistics.
- Predictive risk management.

Back office AI

- AI offers major time saving, cost reduction, and reliability and reliability by intelligent optimization.

- Cognitive automation relates to the usage of a mix of AI and programmed system technology (RPA) for good company system optimization.

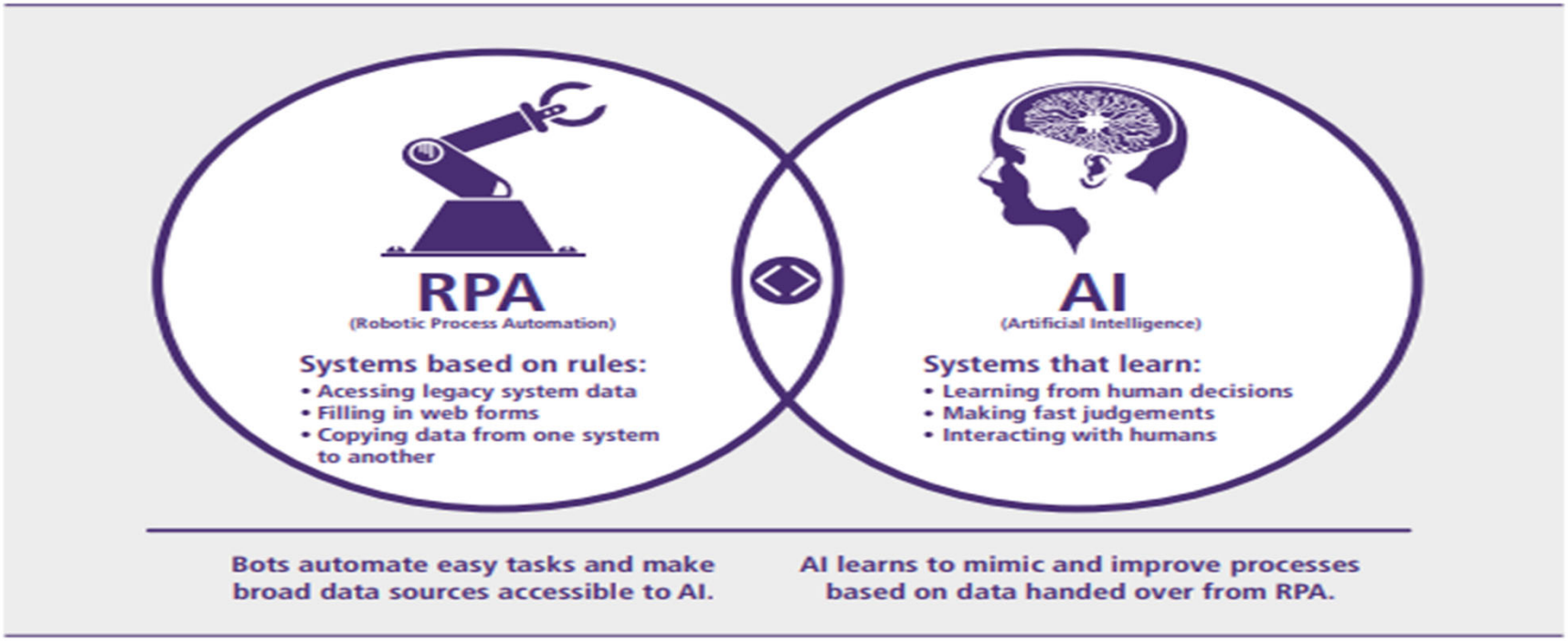

Figure: Back office AI

Source: Ernst & Young

Cognitive customs

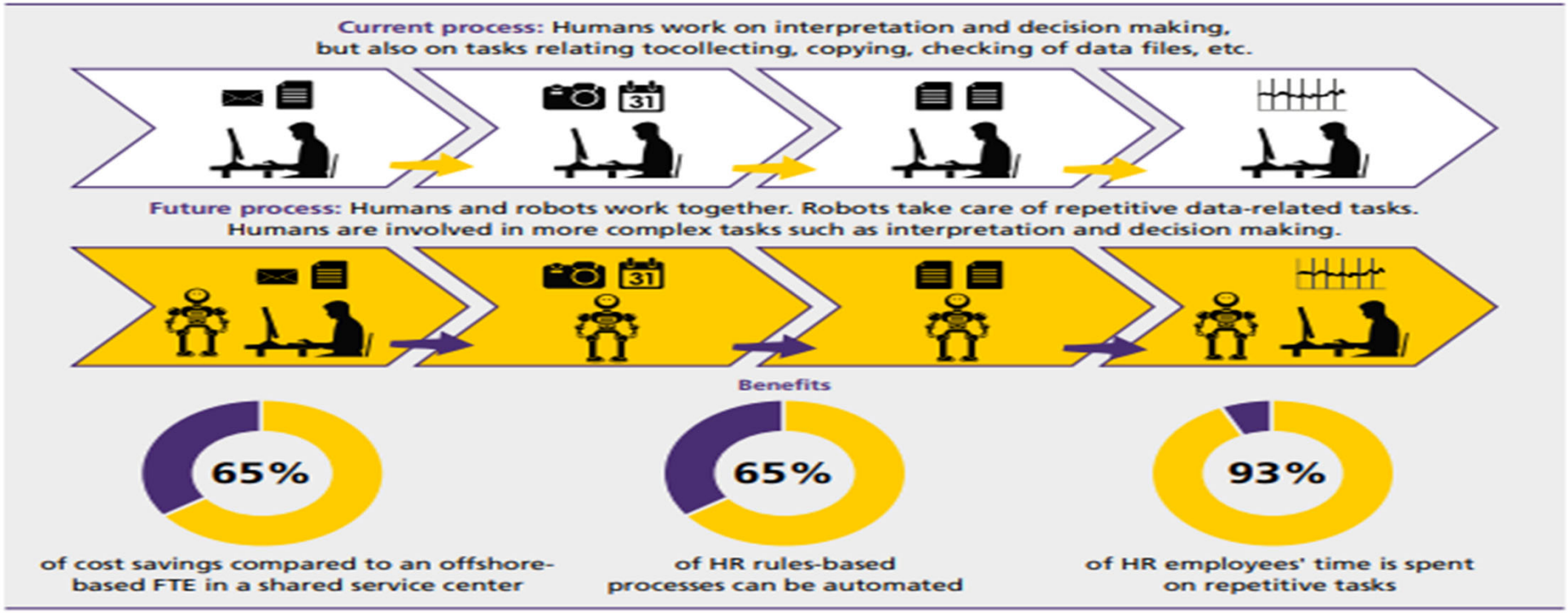

Figure: Comparison of existing RPA-assisted back office processes and future processes

Source: Ernst & Young

Predictive logistics

- This section will identify possibilities for global prediction at the network level as well as opportunities for process-specific prediction.

- This approach may categorize the top variables that affect shipping delays, including seasonal factors such as day of exit or administrative factors such as on-time performance of airlines.

- AI can recognise both the rise in numerical participation in a subject and the importance of that interest in its current state from the linguistic knowledge of unorganized text.

- The AI classifier reflects a datatype mirroring the measured average existing trade development and world trade in the next two months.

Predictive risk management (1 of 2)

- Predictive risk management is critical to maintaining the stability of the distribution store.
- Managing the allocation of resources from thousands of foreign suppliers for distribution store executives in many sectors, namely automobile, communications, engineering and industrial fields, is a regular part of the business.
- For efficient distribution providers to stock, collect and supply, intellectual path automation is critical.
- Procurement companies and specialists usually have solid, clear and implicit awareness and functional features of the group in the last-mile delivery.
- Smart robotic sorting is efficient heavy-speed mail processing, packing and even partially disassembled delivery one of the most critical operations for modern parcel and express operators.

Predictive risk management (2 of 2)

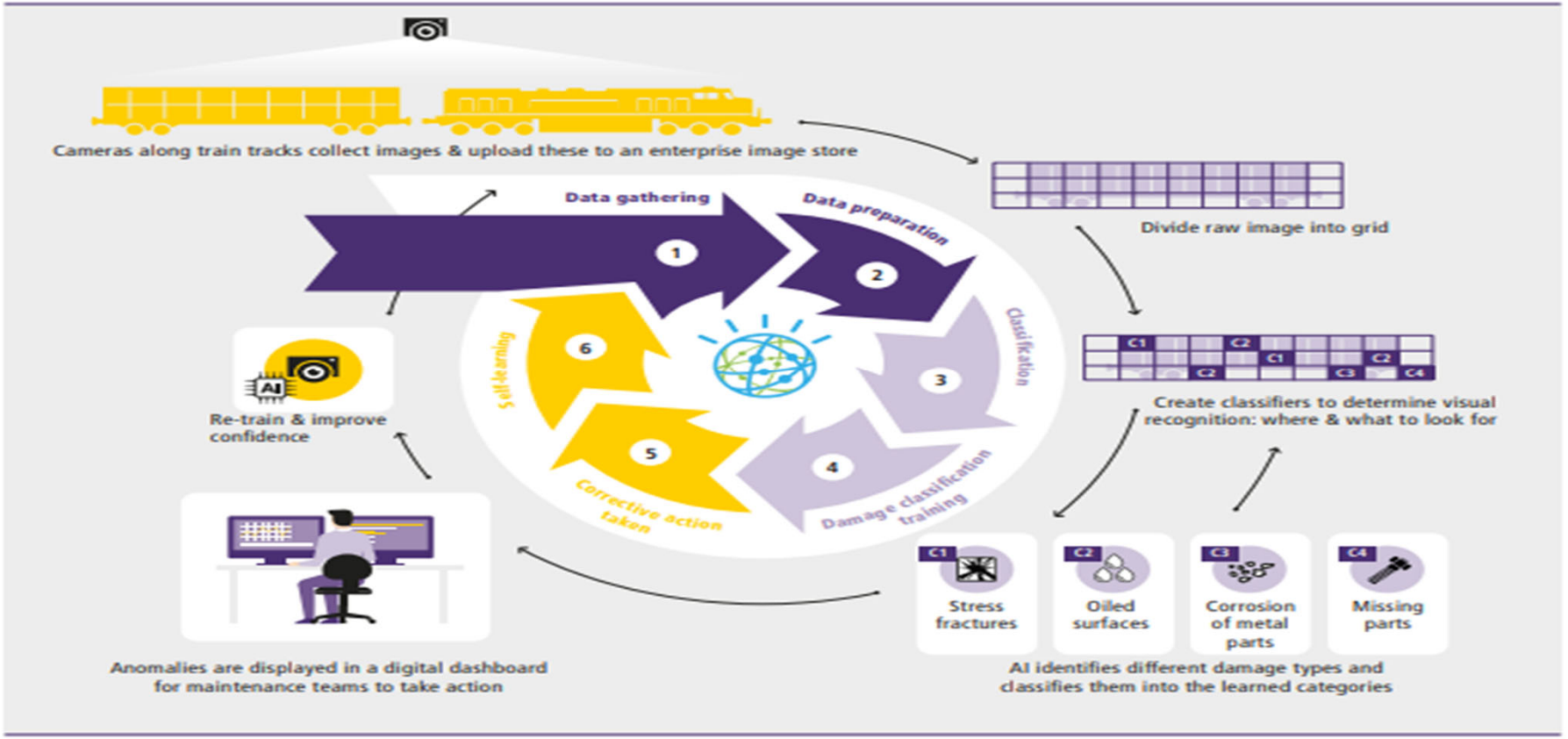

Figure: IBM Watson visual recognition enables maintenance with AI visual inspection

Source: Ernst & Young

Seeing thinking and speaking logistics operations

Figure: Seeing speaking & thinking logistics operations

Source: Ernst & Young

ML powered customer experience

- AI will help logistics companies eliminate all of these consumer touch points through consumer satisfaction and acquisition.
- Speakers will improve and customize the user service of logistics companies.
- The discovery of ai technologies would allow logistics companies to proactively manage their consumer connections.
- Involuntary logistics takes AI-powered distribution customer experience to the next level, bringing products to customers until they even order or realize they need them.
- Involuntary operations seeks to harness ai's ability to interpret and forecast large quantities of information such as browsing habits, purchase background, and social norms, as well as completely irrelevant forms of data such as weather data, social networking activity, and news reports to determine what customers will buy.

Limitations of AI techniques in transpiration

- Approaches to transportation (AI) have been restricted to specific ITS implementations such as statistical analysis and future flexibility predictions.
- it is necessary to realize AI's full capacity to build applications that can run as standalone systems.
- To obtain high accuracy, it is important to develop climate and incident sensitive algorithms and prediction schemes.
- The AI will enhance the efficiency of virtual computation in the development of such algorithms and increase the standardization of spatial and temporal information coverage requirements.

Computation complexity of AI algorithms

- An essential part of AI techniques is the development and evaluation of formulas.
- It takes less time to run the algorithm to be efficient for a large number of sample data.
- The quantity of source information rises in a basic example of the algorithm, the list of procedures increases at a steady level.
- While the number of operations and calculations in polynomial time (X2), additive time (2X) and polynomial time (X!) is described in complicated algorithm scenarios.
- AI addresses issues for motorists and road users such as traffic flow and effective transport planning.

Checkpoint (1 of 2)

Multiple choice questions:

1. Which of the following is an example of feature extraction?
   a) Constructing bag of words vector from an email
   b) Applying PCA projects to a large high dimensional data
   c) Removing stop words in sentences
   d) All the above

2. Which of the following is true about naïve Bayes?
   a) Assumes that all the features in a datasets are equally important
   b) Assumes that all the features in the datasets are equally important
   c) Both a and b
   d) None of the above

3. Which of the flowing techniques can be used for normalization in text mining?
   a) Stemming
   b) Lemmatization
   c) Stop word removal
   d) Both a and b

Checkpoint solutions (1 of 2)

Multiple choice questions:

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Checkpoint (2 of 2)

Fill in the blanks:

1. ---------- process involves both the collection and analysis of traffic data.
2. ---------- modelling uses statistics to predict outcomes. Most often the event one wants to predict is in the future, but predictive modelling can be applied to any type of unknown event, regardless of when it occurred.
3. ---------- is the process of performing risk management activities on hypothetical hazards, risk events, and/or consequences.
4. ---------- refers to the shared used of a vehicle, bicycle, or other transportation mode. It is a transportation strategy that allows users to access transportation services on an as-needed basis.

Checkpoint solutions (2 of 2)

Fill in the blanks:

1. **Incident detection** process involves both the collection and analysis of traffic data.
2. **Predictive** modelling uses statistics to predict outcomes. Most often the event one wants to predict is in the future, but predictive modelling can be applied to any type of unknown event, regardless of when it occurred.
3. **Predictive risk management** is the process of performing risk management activities on hypothetical hazards, risk events, and/or consequences.
4. **Shared mobility** refers to the shared used of a vehicle, bicycle, or other transportation mode. It is a transportation strategy that allows users to access transportation services on an as-needed basis.

Question bank

Two mark questions:

1. List the applications of machine learning in transport.
2. What is incident detection?
3. What is predictive modelling?
4. Define predictive risk management.

Four mark questions:

1. Explain the applications of AI in aviation and public transport.
2. How machine learning can be used for autonomous transportation.
3. What is risk management in banking sector and how it can be addressed.
4. List the limitations of ai techniques in transportation.

Eight mark questions:

1. Explain how machine learning can be applied in logistics.
2. Short not on applications of AI in aviation and public transportation.

Unit summary

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