Machine Learning in Transport & Logistics

Solving global issues with artificial intelligence

Executive Summary

This expert piece tackles research and expert insights around the following topics:

— Current issues plaguing the transport & logistics market
— Machine learning as a viable solution
— Implementing machine learning successfully

The purpose of this document is to provide a concise snapshot of the aforementioned topics, taking into consideration various sources that are referenced throughout this document and extracting the most relevant information from those sources.

All extracts, statistics and images in this report are publicly available and referenced.
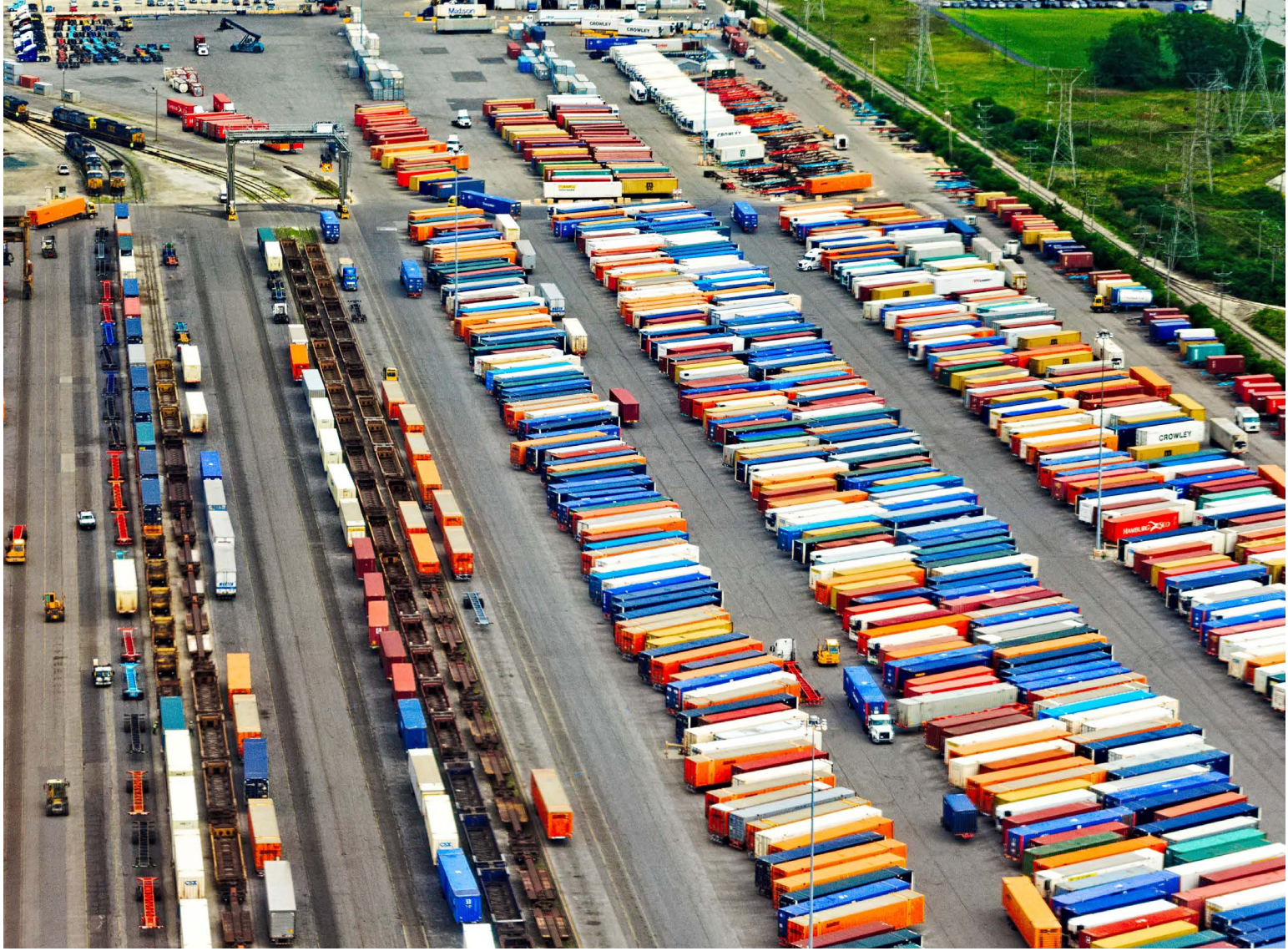
Introduction

The global transport and logistics sector is under pressure. The Covid pandemic has led to an unprecedented increase in global trade leading to global and regional capacity shortage for the transport of goods. This has created a unique opportunity as the global prices of shipping have soared. This is manifested in forecasts that indicate industry growth upwards of 8% in 2021, leading to supply shortage in the industry [1] - and unseized potential. The former being amplified by the incessant growth in number of vendors competing for the same resources. While the world economy is still recovering from the Covid pandemic, the vertical also deals with the overnight transition from public transit to now over-exhausted ridesharing alternatives due to public exposure risk aversion, and whilst simultaneously working to comply with the net zero emissions agenda. In foresight, these challenges will determine the direction of the industry going forward. And intelligent technologies will be the deciding factor.

As of 2021, it is estimated that 25% of truck kilometers are driven without a load, and that the average utilisation of trucks is only 55% across the USA and EU [2]. At the same time, public transit systems such as those in the US are losing an average of 55% of ridership to remote work and/or already overstretched ridesharing companies who are dealing with the bigger problem of accommodating rapidly-growing demands they are currently ill-prepared for [3]. As road freight and transportation remain complex lines of business with variations in demand and sensitivity to global macroeconomic changes, these issues are taking a toll on their respective industries. Fortunately, while such circumstances cannot be controlled, the solutions deployed can be tailored to foresee and react to changes in much more efficient ways. In this paper we investigate how a powerful AI solution built on and equipped with a steady data strategy can deliver significant value to the transportation and logistics industry.

The Era of Machine Learning

As the transportation and logistics industries move into the post-pandemic era of transformed customer behavior, rapidly-evolving sectoral issues, and more unprecedented changes, machine learning proves an exceptionally timely and effective solution against such economic inhibitions. And below illustrates why now is the time to get started.

What's at stake?

With so many trade, technological, and trend shifts taking place across the globe, transport and logistics companies are struggling to keep up and match pace. And although the 'growth spurt' and inflated demands attributed to the boom of home shopping and the generation of a larger taxi or ride-hailing passenger population consequent to Covid-safety enforcements' could be perceived positively, the struggle of supplying impossible demands at a moment's notice in between making operations more sustainable and competitive is costing businesses too much for their current resources to handle and for their employed strategies to overcome.

Responding to the unparalleled success of eCommerce as well as to the public's aversion to mass transport, businesses in ridesharing and cargo are experiencing a trade-wide shortage of workforce and vehicles able to fulfil orders. Mirroring the global supply chain shortfalls, the void caused by last year's forced furloughing and laying off of workers, accompanied by high risks of on the job virus exposure that brought about historically low unemployment rates followed by career shifts into adjacent sectors, is bringing operations and productivity to abysmal rates in proportion to market demand [4]. To illustrate the tremendous influence this labour shortage holds, apart from global shipping delays, inadequate driver to vehicle ration and unfulfilled and limited demand supplication [6], more than 80% of the volume of global trade being controlled by maritime transport is dependent on two million seafarers operating the global fleet of merchant ships. This demonstrates how this kind of proceeding can impact, at scale, the cargo

businesses themselves - with a decapitated workforce dictating or directly affecting the number of transactions fulfilled and revenue generated [7]. Not to mention how a driverless vehicle (especially since autonomous vehicles are not the canonical trend) simply cannot service passengers and turn in a profit.

Businesses are also now at a loss with the amount of un- or under-utilised vehicles stuck in similarly stagnant facilities. With over 45% of truck capacity unused and taking up space in normatively mortgaged or rented parking spaces across the United States and Europe [2], this issue can potentially cost as much as 65% of their supposed combined ROI (calculated at an assumption of a 1.4 return coefficient per unit deployed) in addition to upkeep fees lost to such unutilised capacities and other fleet management costs. The same goes for ride-hailing and even public transport systems with fleets of automobiles and railways operating almost entirely vacant or with an elusive volume of passengers.

AI/ML as the perfect solution

To combat and overcome the aforementioned challenges, a number of options can be employed. With so many disruptive technologies shaking up the sector, an overwhelming array of digital solutions present themselves as the answer. But here's how machine learning proves to be the best response for the previous problems.

Machine learning responds to the issues in a more administrable and controlled fashion, at a larger scale with

Since 2013, workload demand has been exceeding the labour force growth of 180,300 new positions filled a year, at an acceleration parallel to the growing volume of e-commerce sales [5].

roughly the same effort, and with a better timeline than any other solution might offer. Recruitment applications aside, machine learning approaches and tackles asset underutilisation and manpower issues straightforwardly and with fewer mediating variables in place. For example, as opposed to resolving to scale up recruitment initiatives, wherein application structures need be placed, the number of applications received and processed are beyond control, and training, retention, and productivity remain intractable, machine learning strikes at the heart of the issue - enabling efficient, optimum fleet management.

In an oversimplification, feeding machine learning models real-time data on traffic, demand and supply information and training them to calculate and optimise routes, workflows, vehicle distribution, and even to anticipate future demand to help you allocate existing resources better, enables businesses to optimise the work process and fill the gaps created by a labour shortage and poor capacity distribution. This allows companies to achieve more goals with fewer or no unnecessary steps. Although most companies have employed many route planning fleet management initiatives with manual or hybrid systems, route and fleet efficiency has not yet reached the maximum it can be, and machine learning can be the tool to change that.

One of the technologies also rising to the occasion as well as to popularity - autonomous vehicles - can easily come to mind when exploring alternatives to current strategies for both transportation and cargo. However, as innovative and potent as they can be to decrease the perceived effects of labour shortage, it cannot truly be considered as an option today, nor in the near future. As most companies are still in the early stages and companies with considerable progress are manufacturing and employing them cautiously, driverless transport and logistics will take years to materialise [8]. Besides the lack of the infrastructure that will support automated transport, with smarter roads and cities still in development, driverless fleet technologies also require large sums of investments (of which market research shows it is only the fifth prioritised digital integration [9]) and several phases of testing in compliance to regulation that your company might not be equipped for yet [10].

Another considerable way around, although largely analogue - scaling up recruitment to fill in the gaps in labour and to improve vehicle distribution - should be a viable option. But with this approach rendering unsuccessful even before the COVID-struck worker application deficiency in the market, the end-to-end process from recruitment and onboarding, to training and actual employment performance can promise, at best, having more people working for you that consume capital with little to no regard to their performance and duration of service after recruitment.

Applying the science and getting down to business

In terms of specific use cases, here's how machine learning can enable and support businesses to capitalise on existing assets to achieve efficiency and all its implied positive results. As the global transport market continues to be ruled by margins, capacity and geographical coverage, putting the following applications to practice (also found in our Machine Learning in Fleet Management article) can provide your business with the competitive edge it needs.

Route Optimization

Reducing travel time and fuel costs, machine learning provides stakeholders both efficiency and an opportunity for savings. With an advanced Geocoding algorithm ensuring the most optimal clusters paired with real-time traffic analysis, and adjusted calculations able to take into account seasonal volume or road congestion variations, drivers and consumers are not only able to navigate better through traffic, they are also provided more accurate travel time and cost estimations that

help companies understand current dynamics and put resources to better use.

Fleet Management Predictive Analytics & Supply and Demand Distribution

With time-series prediction, machine learning is also able to provide important projections and figures on anticipated demand for different situations, on expected transport speeds, and on average maintenance gaps. These ultimately help fleet managers answer questions and make adjustments on balancing supply and demand, fleet allocation, and price optimization, among others.

Personnel Performance Scoring and Monitoring

By analyzing records and patterns, machine learning offers businesses actionable insights on personnel performance including idling, driver behavior, job completion time, and driving speeds. This knowledge allows business owners to make necessary adjustments in

operation workflows and protocols that in turn, significantly improves productivity and tightens the gap stemming from workforce shortage. In addition, with the appropriate actions taken, this can also contribute to improved customer service and better safeguarded regulation compliance.

Utility Monitoring

Equipped with predictive analytics and real-time data processing, businesses are also able to effectively manage resources and utilities with machine learning. Accounting patterns on risks, maintenance and repair needs, conducive working conditions, and vehicle specifications, machine learning technologies enable convenient and optimal vehicle monitoring, distribution, and use. They also help better inform decisions that create more convenient processes around licensing, maintenance, issue management, regulation compliance, and even vehicle remarketing.

Conflict Response

Combined with rule-based automation and online sensory technologies, machine learning also presents stakeholders with a more time-sensitive response to conflict and damage. In this application, damage analysis, damage control, triggered emergency responses, report creation, insurance process optimization, and prompted authority alerts are all made possible at unparalleled speeds. This effectively reduces compromised functionality or total obsoletion by notifying authorities to employ quick action on vehicle repair, to cite an example.

Tobias Morville, Head of Machine Learning, Monstarlab Denmark

"Data Strategy is the playbook for how you get to a point where you can actually benefit from advanced technologies, such as machine learning. We see too many companies jump straight into the deep end with machine learning proof of concept models that are meant to "prove value". However, without a plan for anchoring the model in the organisation and aligning its use to core business values, not much will be gained from machine learning. This is essentially what a data strategy is meant to answer"

Gearing Up Towards Sustainability

Machine learning also poses a timely use case in the advent of net zero emissions. Calculating your emissions and carbon footprint and identifying from which processes they come from, among many other actionable insights it can provide, can also help businesses set up more mindful processes and more achievable goals.

However promising it may seem, there is a word of caution to note. Not many companies have truly implemented machine learning successfully. In fact, research has found that roughly 85% of Machine Learning projects since 2018 have ultimately led to failure and that this trend will likely persist through 2022 [11]. And we have reason to believe this is due to their lack of preparation. According to research, over 92 percent of leading businesses have already put at least one investment in AI and machine learning in place as of 2021, but only 20% of executives feel their data strategy and involved infrastructure are truly ready for such integration [12]. That being said, before placing investments in the technology, a holistic approach inclusive of a competent data strategy and aligned infrastructure (which normatively constitute 80% of the integration) is required.

Our Recommended Approach

Drawing on the principles of data strategy that create value in machine learning, discussed hereafter is our suggested methodology to successfully implement machine learning.

Developing and integrating Artificial Intelligence/ Machine Learning initiatives is no different to any other major implementation of a system. To ensure success we recommend a systemic approach looking at the dependencies of the solution and targeting items in the right order. The first task, however, is to analyse the system in question to determine the rational linear dependencies of each step for realising the desired outcome.

We recommend using the strategic staircase model to prioritise efforts based on their dependency for the solution. This model has two anchors; the "current state" and the "envisioned future state". By outlining these, we can start to discuss what stepping stones are required to move from the current to the future envisioned state.

This model is predicated on a reverse engineering process. In the case of AI, we can easily make the inference
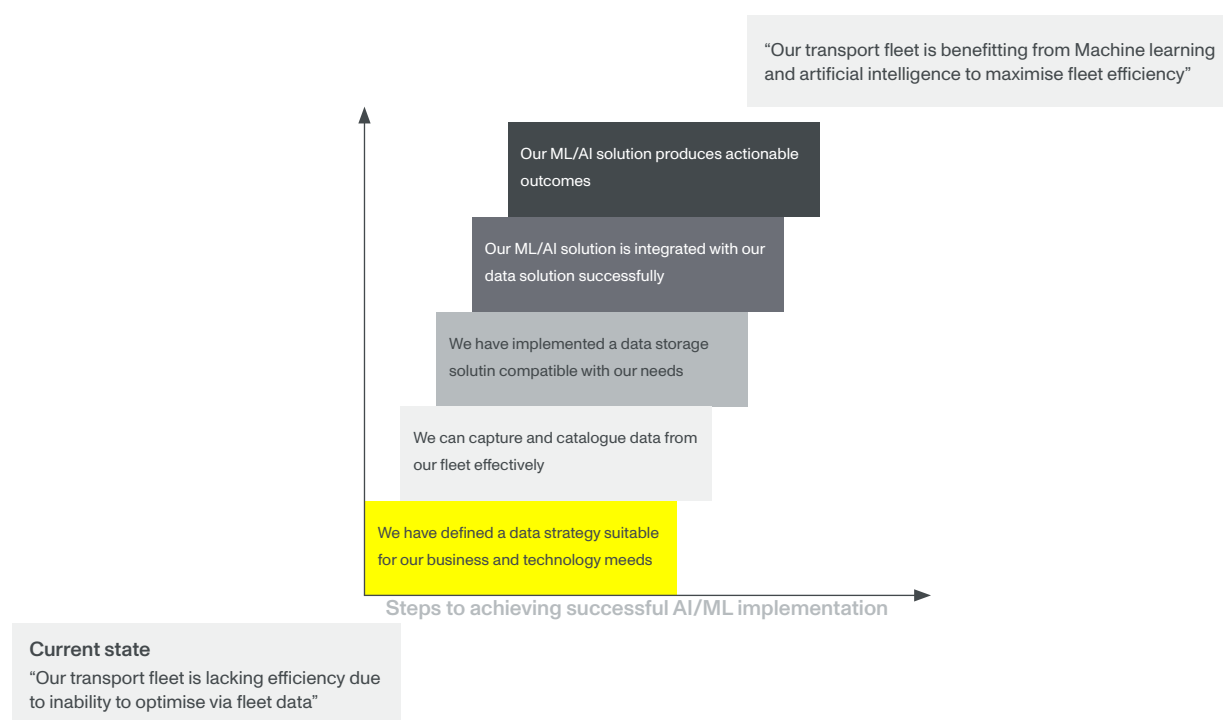
that a successful AI solution that creates efficiencies for the business must be able to produce actionable outcomes that the business can actually use. From here, we simply continue down the staircase by asking what an actionable outcome from an AI solution requires. Again, logically, we can infer that this is for the AI/ML solution to be integrated with a data solution that enables it to function.

Continuously, we move down the staircase developing the logical steps that our approach needs to achieve in reverse. As in the case of an AI solution, we can understand that the foundation of any well functioning AI solution is a data storage solution that is fed information from an operational data capture solution.

Finally, we understand that the process of data capture forces the questions of what data to capture and how, which asks the question of what the "Data strategy of the business" is.

From this model we have now logically arrived at a series of achievements with linear dependency. We now

Data strategy foundation (Strategic staircase)

"Our transport fleet is benefitting from Machine learning and artificial intelligence to maximise fleet efficiency"

Our ML/AI solution produces actionable outcomes

Our ML/AI solution is integrated with our data solution successfully

We have implemented a data storage solutin compatible with our needs

We can capture and catalogue data from our fleet effectively

We have defined a data strategy suitable for our business and technology meeds

Steps to achieving successful AI/ML implementation

Current state
"Our transport fleet is lacking efficiency due to inability to optimise via fleet data"

Anders Kongsbak - Associate Senior Digital Strategy Consultant, Monstarlab UK

"The promise of digital solutions like AI are enormous, but for many companies, the lynchpin remains insightfulness around goal setting and enablement. By setting your sights on the value you wish to create a solution can be devised and developed that logically takes you from where you are now, to where you want to be - regardless of whether that is to create further efficiencies, or to develop solutions of competitive advantage in your field"

understand that if there is no defined data strategy to form the foundation of the AI solution, then we are jeopardising the project at large and any downstream effort. We must therefore principally focus on determining a data strategy that can enable the business to achieve the desired outcomes from an AI solution in the end.

The depiction of the process above is simplified and leaves out important details about the solution space in question. However, it should outline why it is important to focus on the lower components with dependency in a linear system. This ensures that the solution being implemented will have its needs covered in logical sequence once complete.

A functional AI/ML implementation hinges on a suitable data capture and storage solution. Without proper access to data. This is why the first step in the implementation of an AI/ML solution is to determine the business requirements of an AI solution and design an appropriate data strategy that can support it.

As we have shown using the strategic staircase will enable the business to prioritise efforts in the right order maximising the chance of success. Not just success in successful implementation, but success in delivering the desired value.

Key Takeaways

The transport and logistics industry continues to be challenged by tough competition as well as the covid pandemic and net zero emissions targets.

To emerge in a strong position, companies must consider how they leverage the tools available to maximise efficiency and build a foundation for the future. Machine learning, integrated successfully, exploits the tight margins needed to be competitive in the fast-growing global intelligent transport market.

But only with a strong data strategy can you set your business apart from others hopping in on the trend. Now with a better understanding of how data and machine learning work together, you can generate increased values from your operations while building the foundation for the future of your business.

Experts behind this piece

Anders Skjøt Kongsbak

Anders is one of Monstarlab's Strategy Consultants. He holds a degree in Business Management and Finance. His work focuses on developing and delivering target operating models for businesses specifically in regard to digital initiatives.

Tobias Morville

Tobias is the Head of Machine Learning at Monstarlab. He has a PhD in Computational Neuroscience and has worked with designing, developing and deploying machine learning models in both Danish and international companies for the last four years.

Co- Author

Andrea Monica Nalupa

Andrea is one of the global marketing team's research and copywriters - focusing on multiple verticals and a broad range of content.

About Monstarlab

Originally established in 2006 in Tokyo, Japan, Monstarlab has grown into a borderless digital consultancy with 29 global offices and powered by more than 1,200 strategists, designers and engineers who excel at strategy and delivery.

Specialising in end-to-end enterprise-level digital solutions, the company has successfully delivered more than 2,200 projects, including for world-renowned corporations such as Santander Consumer Bank, Danske Bank, Mashreq Bank, and Fortune Global 500 company China Taiping Insurance Holdings Company.

On top of banking, financial services & insurance, the company has strong expertise across sectors, including health & life science, wholesale, retail, & eCommerce, as well as transportation & logistics.

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