



WHITE PAPER

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Influence of

Artificial Intelligence and Machine Learning

in the Telecom Industry



Introduction

Artificial intelligence and machine learning play a vital role within the telecommunications industry – a role that's only growing in importance as companies seek to improve and enhance the customer experience through targeted marketing, proactive maintenance, and AI-optimized networks.

Every marketing manager in telecom and other industries must identify their customer wants and needs and deliver a message that meets them. Mobile devices collect data on people's behavior. AI automates the analysis of that data, providing previously unavailable insights that give a better understanding of customer needs.

AI can also enable telecom companies to detect and predict network anomalies, proactively fixing issues before customers are negatively impacted.

AI also assists with network optimization: A Self Organizing Network (SON) fueled by artificial intelligence can help networks continually adapt and reconfigure based on current needs and historical trends. AI is also beneficial when designing new networks, and is more efficient at providing consistent service.

AI impact in Telecom

Mobile Marketing

Mobile and user data is a boon for marketing teams in most industries, and telecom is no different. AI can help telecoms improve customer retention and user experience, while also generating higher profit per user, through the following:

- Making personalized recommendations based on a user's behavioural patterns and content preferences
- Making relevant upsell and cross-sell offers to the right users at the right time
- Assessing which call & data packages best suit different users, and promoting these packages accordingly

Why Machine Learning

To develop highly targeted campaigns and programs using mobile AI technology to exponentially increase return on investment (ROI), instead of regular campaigns requiring more resources and time.

How Can Machine Learning Help?

With the help of machine learning algorithms, the marketing team can precisely target their audience based on its most relevant needs.

Machine learning algorithms can learn from CRM data, and provide personalized offers to each customer via mobile notifications.



How Does it Work?

- The data engine collects all data from the user base of the telecom company. This data is then fed into the AI engine.
- By analyzing data patterns, AI clustering algorithms next group customers into various clusters based on demographic data such as age, income, location, gender, and usage trends.
- Once these clusters are classified, a custom marketing campaign can be sent to each group.
- Personalization of messages to individual customers in each cluster also can be implemented using natural language processing (NLP).

With the help of AI and machine learning, marketing campaigns can be created and sent to target audiences with minimal human supervision.



Preventive Maintenance Using AI

Recent advancements in machine learning can make an important part of the technical team's work proactive rather than reactive:

By combining alerts, network events, customer experience index, technical metrics and reported technical incidents, ML algorithms can help predict faults before they happen.

Algorithms can discover and point out which parts of the network need investments, based on which investments could produce the highest ROI.

Network operators can use AI to identify overloaded networks that would benefit from network improvements, thus leading to better service and higher profit.

Why Machine Learning?

Operators typically receive millions of alarms from their access, transport and core networks, each composed of various equipment types from multiple vendors. The network operations centre (NOC) team is usually busy responding to this high volume of alarms and reacting to thousands of incidents on the ground.

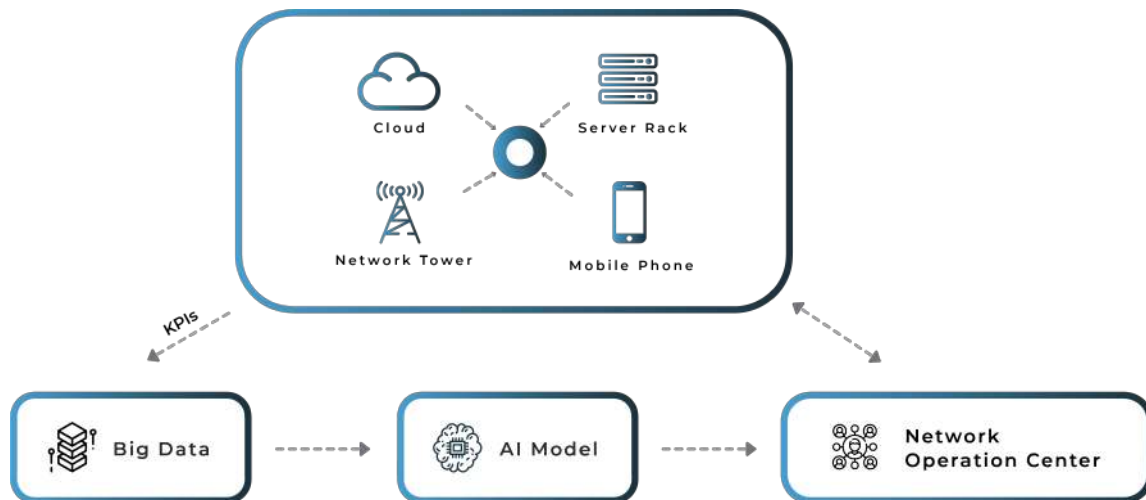
During this time, preventive maintenance can be executed using an AI model that helps reduce outages and improves customer experience.

How Can Machine Learning Help?

The prediction of network outages in earlier stages helps with prevention. Machine Learning models are used to recognize patterns, make predictions, learn the statistics of sequential data, and provide early warning indicators based on service key performance indicators (KPIs) like mobility, retainability, throughput, and accessibility, to help understand the system's health.

This analysis is then used to find the performance/behaviour of the network's outliers out of all its elements, including cellular towers, network servers, and satellites.

Drop in KPIs, or the detection of abnormalities or degradation, indicates the possibility of a hardware/system failure



How Does it Work?

- Software logs, deviation in hardware signals, triggers signalling an outage, and other signals are collected from internet of things (IoT) devices, network towers and server racks.
- Key performance indicators like mobility, retainability, throughput, and accessibility are segregated and stored in big data servers.
- These data are fed into the AI engine, which predicts anomalies based on KPIs, then sends early warning indicators to the NOC team.

The above process helps telecoms fix issues proactively, before they become big problems.

AI predictive models drive network maintenance capabilities. This improves customer experience & operator revenue by significantly improving network uptime.

Network Optimization Using ML

AI-enabled networks are capable of self-analysis and self-optimization, resulting in greater agility and precision. Algorithms can monitor millions of signals and data points within a network to detect impending problems in real time, as they occur, in order to:

Optimize the behaviour of the network based on daily movements and real-time usage data.

Enhance network utilization and customer satisfaction through dynamic resource allocation.

How Can Machine Learning Help?

The AI-based self-optimization model monitors and analyzes performance data, automatically triggering optimization commands to the respective network elements when required. This keeps the network optimized at all times, significantly reducing manual intervention.

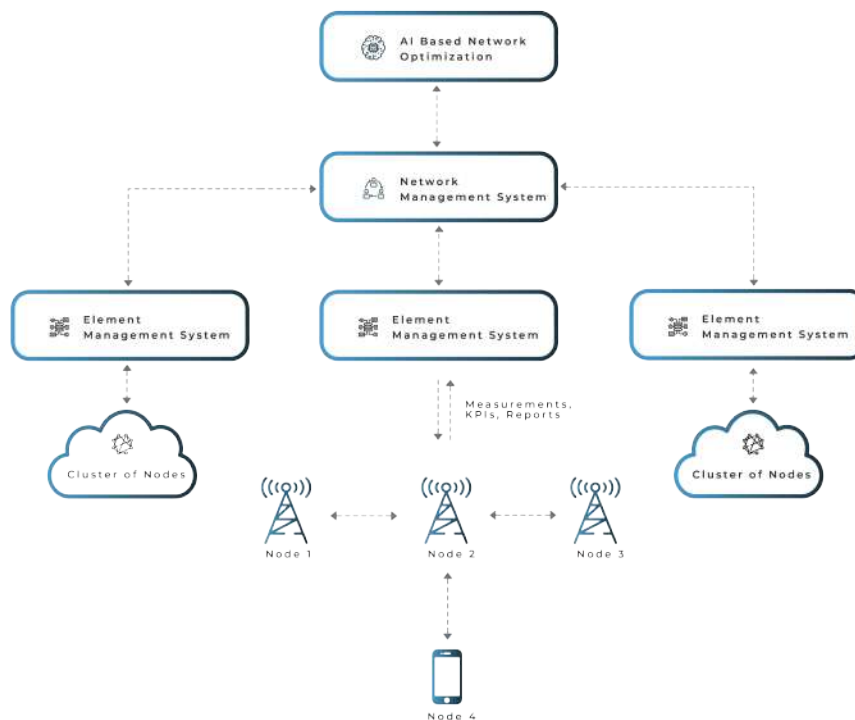
There are three types of self organizing network (SON) architectures:

- Centralized SON
- Distributed SON
- Hybrid SON

Network optimization can be done at two levels: The network management level, which is a cluster of elements, or at the element level. An element is simply a cluster of nodes. Nodes are electronic devices capable of creating, receiving and transmitting information over a communications channel.



Centralized SON - In a centralized SON architecture, performance measurement data and reports are collected from network elements. The AI engine then utilizes this data to detect network load, providing commands and parameter settings to the network management system (NMS). The key advantage of this approach is that SON algorithms can take information from all parts of the network into consideration. The main drawbacks of this architecture, however, are longer response times, increased backbone traffic, and its reliance on a single point of failure.



Distributed SON - Here, SON algorithms are run in the network's nodes, with the nodes exchanging messages with each other. This architecture is more dynamic than centralized SON, as the network can adapt to changes more quickly and it is highly scalable to account for any increase in the number of cells in the network. The main drawback of distributed SON is that the optimization done at the cellular level does not result in optimum performance of the network as a whole.

Hybrid SON - This one has the advantages of both centralized and distributed architectures, since part of the algorithm is run on the network level and the other part runs on the network element level.

Implementing self-organizing networks results in a completely automated network platform that self-monitors, adjusts, and optimizes the network without manual intervention.

How Does it Work?

In a hybrid SON architecture, the measurement data (from nodes), KPIs, and reports are collected from the network elements by the element management system (EMS).

The AI engine utilizes this data to detect network coverage and traffic load, then provides commands and parameter settings to the network management system (NMS).

Network hyper parameters are next optimized to slowly adapt radio access network (RAN) algorithms to different network scenarios and conditions.

Live network data coming from the radio access network (RAN) is used to enhance coverage plots and identify hot spots where additional capacity is needed.

The above steps bring the performance of a certain area of the network (a particular cluster of cells, for example) into a steady state, wherein specific KPIs are improved. This helps proactively address network performance dips and outages even before a customer experiences them.

It also helps keep subscribers happy through preventing and resolving complaints, while avoiding unnecessary investments in costly infrastructure expansions and new site additions through a proper choice of parameter settings.

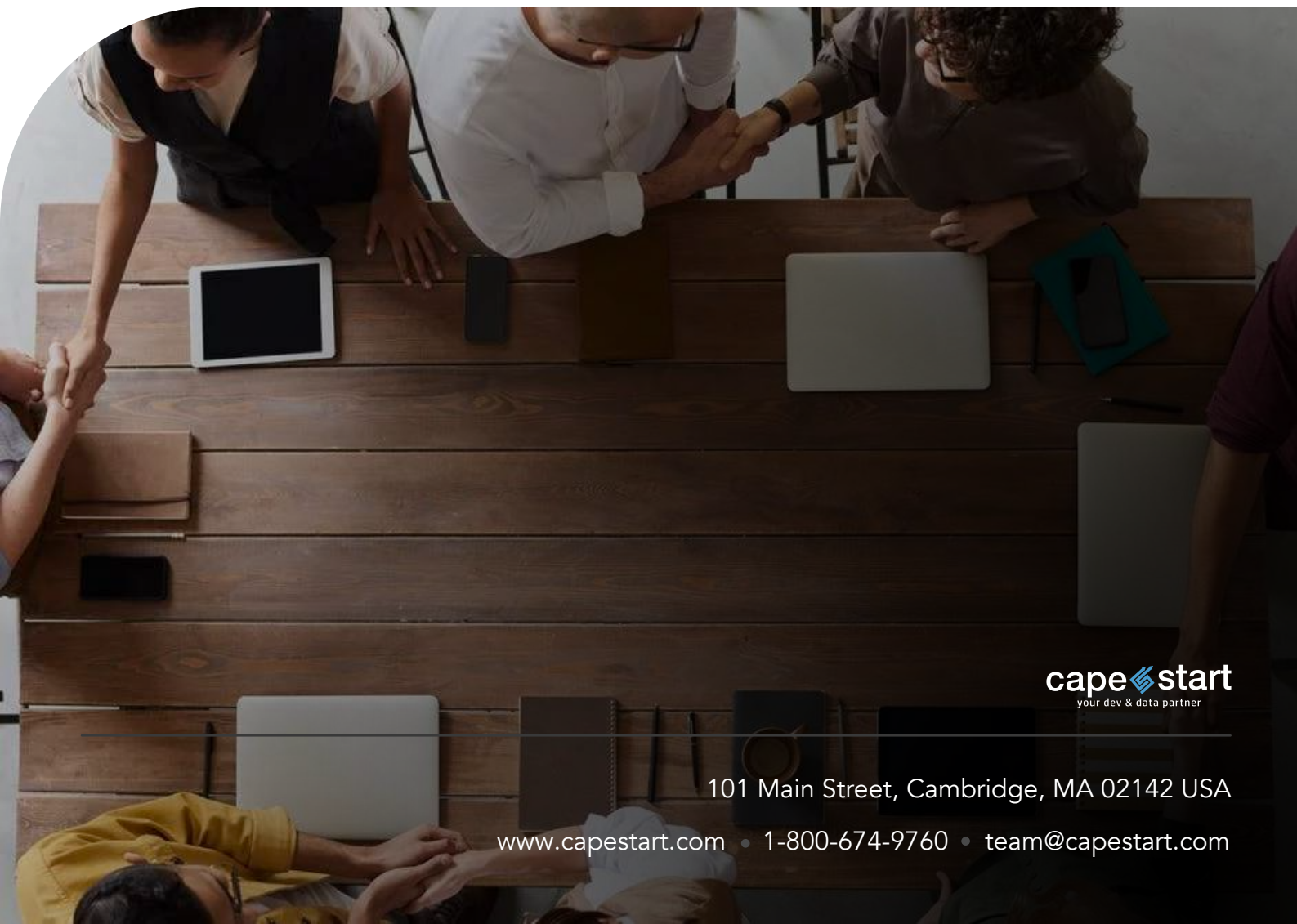
Conclusion

AI and ML have enabled the telecom industry to extract insights from their vast data sets, made it easier to resolve issues, manage daily business more efficiently, and provide improved customer service and satisfaction.

AI applications are increasingly helping communications and services providers manage, optimize and maintain infrastructure and customer support operations.

About Capestart

CapeStart is a Machine Learning as a Service (MLaaS) company offering a wide range of AI solutions, with particular expertise in Natural Language Processing, Computer Vision and Predictive Analysis. With our headquarters in Cambridge, MA, and a dedicated workforce operating from our campus in Nagercoil, India, we help businesses reduce cost, complexity and risk by enabling data-driven decision making.



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