

Turing Point Pty Ltd



Machine Learning for Enterprise Solutions: White Paper

by Dr Tirthankar RayChaudhuri

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Turing Point Pty Limited

30/23 Good Street, Parramatta

NSW 2150 AUSTRALIA

+61-(0) 410-455-676; +61-(0) 421-198-856

ACN 110 882 46; ABN 42 110 882 463

www.turing-point.com



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Who should be contacted by parties interested in this proposal ? (genuine enquiries only please!) 12



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EXECUTIVE SUMMARY

Machine Learning is one of the most versatile, powerful and effective areas of advanced computing technology today. It can be used to solve business problems in any industry domain where the relevant data is available. A Global Centre of Excellence in Machine Learning will boost a technology corporation's image, profile and business prospects significantly.

The *what's*, *why's* and *how's* of Machine Learning, its relevance today, its advantages over other methods and where it can be applied effectively, are described in some detail.

Some specific applications to primary industries such as Mining and Agriculture that have been identified, are described. Application of Machine Learning techniques to various other industry verticals is also discussed.

It is also discussed how Enterprise Machine Learning integrates with the Industrial Internet and IoT.

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MOTIVATION, STRATEGIC RECOMMENDATION

Machine Learning is one of the most versatile, powerful and effective areas of advanced computing technology today. Investment in such an area will boost a technology corporation's image and profile significantly, add enormous value to customers, create revenue growth and jobs and attract the best talent.

A Centre of Excellence and Innovation that can develop machine learning solutions on a wide scale and address the needs of *global clients* is a highly-recommended strategic direction for a high-technology global corporation that has a large client base.

WHAT IS MACHINE LEARNING AND HOW DOES IT SOLVE BUSINESS PROBLEMS?

Machine Learning is a branch of Computer Science, involving the deployment of advanced algorithms that discern the relationships/structure in real-world data (ie, 'learn' from past business experience) and are able to use the learning to predict the outcome of future *targeted* or *anticipated* business scenarios. Conducting medical diagnosis from symptoms from a new patient based on learned 'examples' from historical patient data, is a typical example. Optical Character Recognition (OCR), Email spam detection and high quality voice recognition via the Google Now app are other examples from everyday activity.

Additional examples of Machine Learning applications to industry are

- i) Churn Prediction (eg, in Telco, Banking, etc)
- ii) Sentiment Analysis
- iii) Intelligent online advertising
- iv) Intelligent Personal Agents
- v) Intelligent Content Search
- vi) Veracity detection of online publications
- vii) Making personalized recommendations for customers

- viii) Forecasting long-term customer loyalty

- ix) Anticipating the future performance of employees

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- x) Rating the credit risk of loan applicants

It should be noted that the above is by no means a comprehensive list.

WHY IS MACHINE LEARNING SO RELEVANT TODAY?

While researchers have been working on Artificial Intelligence disciplines such as Machine Learning for *over 5 decades*, there existed earlier a *major roadblock* to migrating these techniques from the Research Lab to the Business Enterprise.

It was the *enormous computational expense* involved. Today this is *no longer an issue*.

The *good news* is that enterprise servers today have the computing power and capability of yesterday's supercomputers! Servers, processors, processing memory, network and storage capabilities and speeds today are hundreds of times greater than they used to be. As a consequence highly complex computing algorithms/data processing involving enormous volumes of data can be run in a few minutes, even seconds, instead of days and sometimes weeks.

Business automation has come a *very long way* since the early days of calculators and vending machines. In today's Business Enterprise world ERP, CRM, OLAP and BI are commonplace terms. These are multi-tiered complex 'traditional' software systems that run on distributed computer infrastructures and exhibit high-performance in terms of speed and user-loads. Such systems may include advanced logical reasoning and some analytics, but do not have machine learning features *yet*. However the Business Enterprise is now migrating at a fast pace towards the new 'digital' world of Cloud, Mobile Apps, Social Media and Big Data Analytics. With the plethora of data (big data) available on these digital platforms, leading organizations such as Google and Facebook are hiring the *gurus* of Machine Learning to make their platforms and offerings smarter.

Thus the next generation of 'Enterprise Machine Learning Systems' is imminent!

WHAT KIND OF HUMAN REASONING PROCESSES CAN MACHINE LEARNING EMULATE AND IMPROVE UPON?

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Machine Learning can emulate any kind of logical human reasoning process based upon information and learning from available information, ie, data. Owing to the high processing power, I/O speeds, high network bandwidth and enormous data storage capabilities of modern enterprise infrastructure, Enterprise Machine Learning Software of the future will automatically process and analyse 'big data' information hundreds of times faster than the average human intellect.

WHAT RANGE AND KIND OF BUSINESS ENTERPRISE PROBLEMS CAN BE RESOLVED BY MACHINE LEARNING?

A wide range of business enterprise problems (some have been mentioned in a previous section) can be solved effectively by Machine Learning,

eg, customer behaviour/response predictions, complex financial/market analysis and predictions, medical diagnosis, capacity management of engineering systems/services, complex task scheduling/rosters, predicting mining prospects, optimizing manufacturing outputs, security analysis, macro-economic predictions and so on..

WHY ARE ENTERPRISE MACHINE LEARNING SYSTEMS WORTH EMBRACING?

Enterprise Machine Learning Systems are worth embracing because

- they emulate human reasoning for decision making
- if designed properly they are far more accurate than other paradigms
- they can be used to solve business problems in any industry domain where the relevant data is available
- They can learn from 'noisy' data much in the same way as humans

WHAT IS THE ADVANTAGE OF USING MACHINE LEARNING FOR BIG DATA PREDICTIVE ANALYTICS OVER OTHER TECHNIQUES SUCH AS STATISTICAL REGRESSION?

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Unlike other popular data analytics techniques such as statistical regression which requires data to be cleaned of 'noise' before it can be used, machine learning techniques such as Deep Learning can learn from noisy data in exactly the same manner that the human intellect does.

HOW SHOULD WE GO ABOUT BUILDING ENTERPRISE MACHINE LEARNING SYSTEMS?

Building Enterprise Machine Learning Systems of the future will require

- fresh perspectives and vision
- investments and budgets based on business cases and ROI analysis
- leadership insights based on knowledge and awareness
- the willingness to hire the necessary skills and teams
- tools, technologies and methodologies relevant to the domain

WHAT KIND OF FUTURE ENTERPRISE MACHINE LEARNING SYSTEMS ARE UPCOMING IN THE NEAR FUTURE?

A few upcoming Enterprise Machine Learning Systems are listed below

- ERP, CRM, OLAP and BI systems with Machine Learning and Prediction capabilities
- Predictive Analytics systems based on Machine Learning Algorithms (imminent)
- Advanced Speech Recognition (already in place) and NLP Interfaces
- Intelligent Personal Agents on Smart hand-held devices (already in place)
- Improved Optimal Control of Industrial Processes such as Manufacturing and Mining
- Adaptive Control of Industrial Processes such as Manufacturing and Mining

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However the list of potential future developments is clearly *without limit*.

WHAT KIND OF DEVELOPMENTS HAVE OCCURRED IN THIS AREA ALREADY?

While there are a number of fairly recent generic machine learning development platform products already in place today such as

- Amazon Machine Learning,
- Microsoft Azure ML Studio,
- Numenta,
- Bayesia Labs and
- IBM Watson,

deployment of Machine Learning to address *specific enterprise vertical business problems is only just beginning*. We are aware of

- TCS's 'Ignio' initiative in this area and also of
- 'Wipro Holmes' by Wipro.

PRIMARY INDUSTRIES SUCH AS MINING AND AGRICULTURE HAVE GREAT POTENTIAL IN APPLICATION OF MACHINE-LEARNING BASED SOLUTIONS

The **Mining** Industry is facing a crisis in the recent times. According to PricewaterhouseCoopers' 10th annual global report, *Mine: A Confidence Crisis*, rising costs, profit falls and dropping planned capital expenditure, are all signals that the sector is in for a tough ride. According to the PwC report: Inefficiency is destroying value in mining.

Like any other major vertical, mining has already embraced the advantages of Information Technology via solutions such as

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- the 'Geovia Dassault' or 'Maptek' suites of Mine Planning and Mining Activity scheduling software and
- the 'Micromine' or 'Modular Mining' suites of Mine Production and Mine Management solutions

While such technologies do enhance productivity and profitability by automating operations and reducing human labor requirements considerably, such solutions do not necessarily also examine operational performance or exploration data (that is being continually generated) with a view to further improving productivity and reducing risk.

Recently, following the Sept 2014 Summit on Big Data Analytics in Mining held in Brisbane, it is now acknowledged that Mining companies investment into IT is due to multiply by 5 in the next 3 years and with every phase of a mining company's value chain producing large amounts of data on a daily basis, *adaptive control and big data predictive analytics* will certainly be a large part of this increase. A particular area of focus is real-time data acquisition and predictive analytics in order to improve the day-to-day operations of a mining company.

Utilizing such technologies effectively can make a huge difference to the bottom line of any mining company, and it also offers enormous competitive advantage in this *challenging industry and difficult economic climate*.

One of the unique features of this paper is identifying the application of the power of Deep Learning to Mining Industry Data (including geo-mining data) for which we believe this is a *pioneering venture*.

A few of these solutions/use cases are briefly described as follows

- Adaptive Control Of Mining Operations
- Optimal Control of Mining Operations
- Safety of Mining Operations
- Reduction of Risk in New Mining Prospect Explorations

using *Deep Learning*, a form of Machine Learning based on a set of algorithms that model high-level abstractions in data by using complex architectures composed of multiple *non-linear transformations*.

Such solutions, once implemented will result in the saving of hundreds of millions of \$\$ for a large mining enterprise.

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In the **Agriculture** Industry, manual inspection of harvested fruit/vegetables is costly, time-consuming, human judgment dependent, hence non standard and prone to error. Millions of dollars of cost is incurred in contamination of fresh produce by rotten produce despite such manual inspection.

There is great scope for applying Machine learning for classifying patterns from thermal/visual sensor data on fruit/vegetable farm produce - for contamination/quality control, enhancing efficiency of market-ready production and minimizing the huge losses due to contamination.

Machine learning can also be applied for *optimal control agricultural machinery* such as tractors, threshers, crushers, etc if such machinery is fitted with appropriate sensors to obtain their performance measures such as speed, load, throughput-rate, etc.

WHAT OTHER AREAS OF INDUSTRY CAN MACHINE LEARNING ADDRESS OTHER THAN MINING AND AGRICULTURE?

Other than Mining and Agriculture, Machine Learning can be used to address business problems in *all industry verticals* that generate data.

For example, *deep learning* can be used for improved optimal control of any kind of automated **manufacturing operation** where parameters are measured. A deep learning agent can also be trained to enhance **safety** by triggering alarms in any kind of environment whose parameters are measured and whose historical data is retained, eg, airline and train operations.

Other areas are forecasting *customer behavior* and loyalty by using techniques such as **sentiment analysis**, predicting employee and sales **performance within a corporation** by training a deep learning agent on past relevant enterprise data.

A number of other applications have been mentioned in earlier sections of this paper. The potential and possibilities of *Enterprise Machine Learning* as mentioned previously, are unending.

HOW DOES ENTERPRISE MACHINE LEARNING RELATE TO THE INDUSTRIAL INTERNET AND IOT?

Enterprise Machine Learning is based upon the gathering of data.

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The more data is made available the better the performance of a Machine Learning agent. In 'digital' industrial scenarios, such data can be collected via sensors connecting various industrial devices to the internet (IoT). It is predicted that by 2020, 50 billion devices will be connected to the internet. It has already been recognized that predictive analytics from Big Data emanating from the IoT has the potential to save enormous industrial operational costs and this combination of digital techniques has been termed today as the 'Industrial Internet'. Machine Learning which is a data-based paradigm will integrate well within an Industrial Internet framework as it can be used for both *anticipated* as well as for *targeted* business outcomes, ie, for analytics and also for control.

WHO SHOULD BE CONTACTED BY PARTIES INTERESTED IN PROGRESSING THE BUSINESS OPPORTUNITIES PRESENTED IN THIS PAPER? (GENUINE ENQUIRIES ONLY PLEASE!)

If you are interested in this Opportunity to Invest then pls contact

Dr Tirthankar RayChaudhuri,
@ Turing Point Pty Ltd
tirthankar@turing-point.com
+61 410 455 676
www.turing-point.com