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Grooming the next generation of accounting professionals for the age of artificial intelligence.

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CHARTING THE FUTURE OF ACCOUNTANCY WITH AI

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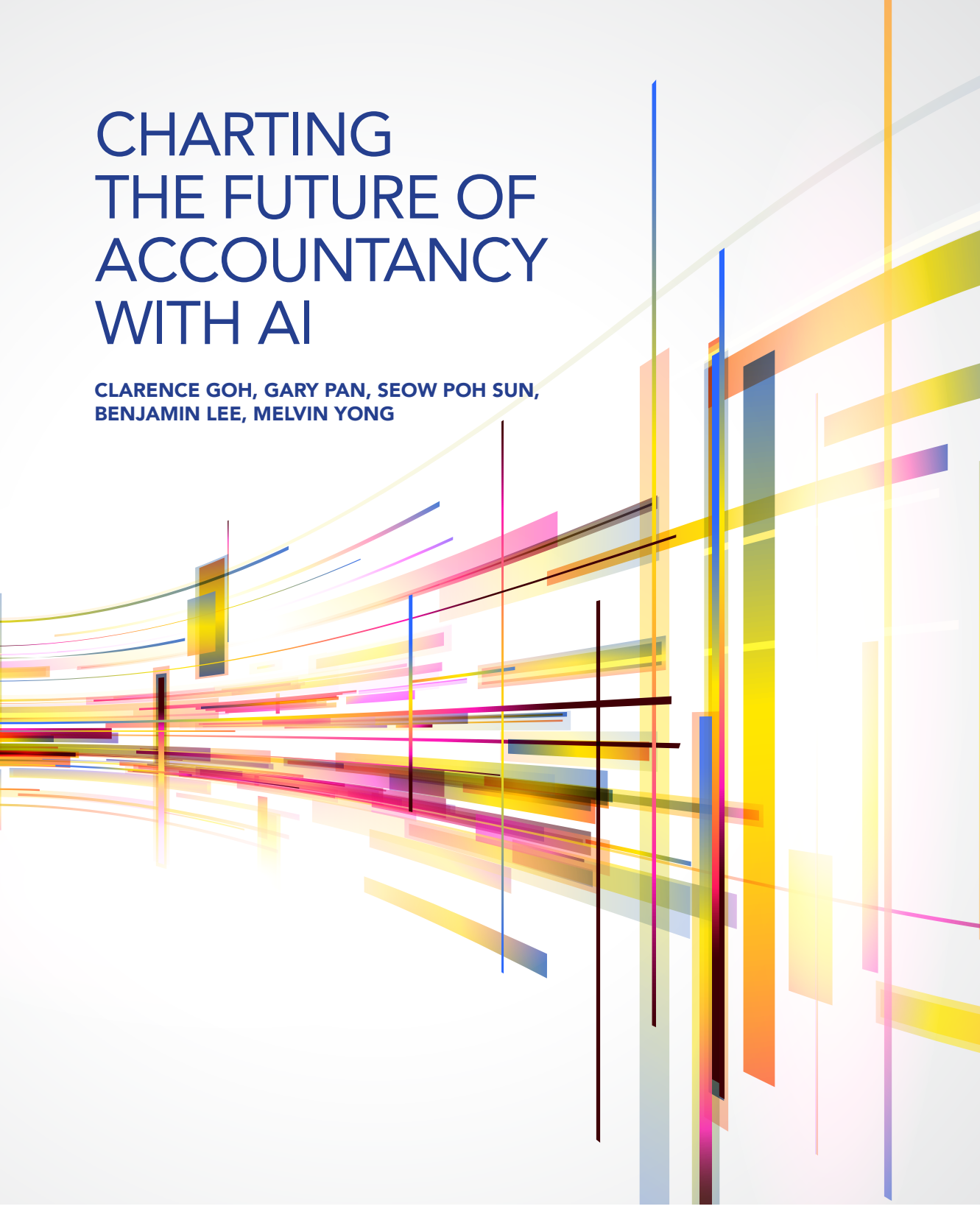

SMU SINGAPORE MANAGEMENT UNIVERSITY
School of Accountancy

CPA AUSTRALIA

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GROOMING THE NEXT GENERATION OF ACCOUNTING PROFESSIONALS FOR THE AGE OF AI

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Artificial Intelligence (AI) is going to transform every economic sector, including accounting industry. As accounting functions rely more and more on machines to calculate, reconcile and respond to inquiries from other departments or clients about balances and verifying info, accountants can now better deliver efficiency and create higher value for their organisations. This transformation means that repetitive, manual and tedious tasks are handled by machines while accountants focus their attention on higher-level, more sophisticated tasks that involve professional judgement and interpretation.

Broadly speaking, AI technology may be categorised into machine learning (ML), deep learning, machine reasoning, and natural language processing. Among these sub-categories, ML has the largest array of applications and functionalities that can most support the work of an accountant. It is known that major accounting practices have applied and are continuing to adopt ML techniques to streamline their operations in order to achieve time and cost reduction, increased productivity and improved accuracy. For instance, one of the Big Four accounting firms has deployed a system that could evaluate credit information related to a bank's commercial loan book, including unstructured data from social media. In this application, ML technology is deployed to establish forecasting models that, based on data from the past, generate predictions on identifying 'problematic' loan transactions.

With ML, computers can recognise and apply patterns, derive their own algorithms based on those patterns, and refine those algorithms based on feedback. Similar to human-beings, ML algorithms need to be trained at its infancy phase, which come in the form of data. With more training examples, the more they learn, the better they get and the more accurate their predictions will be. ML's models are perceived to be consistent decision-makers as they do not exhibit human biases. Conversely, human's strength lies with its ability to interpret novel situations quickly and handle them effectively.

For ML to work effectively, it is important to ensure data sets that are used to "teach" machine learning algorithms, do not have inherent biases. Success of these ML models also depends on having sufficient data of the right quality. While ML has several benefits, it does bring about certain level of associated risks. As such, considerations will have to be taken in evaluating design and effectiveness of internal controls over ML risks.

MACHINE LEARNING IN ACCOUNTING APPLICATIONS

Increasingly, ML techniques have been applied in accounting applications. For instance, by going through the source data of historical transactions, ML is able to predict classification of additional accounting transactions as they are recorded.

In audit, ML is able to learn a company's expense policy, read receipts and audit expense claims to ensure compliance and forward questionable claims to humans for approval. ML can also facilitate risk assessment mapping by pulling data from every project a company has ever completed, to compare it to a proposed project. Such comprehensive assessment may be impossible for humans to do on a large scale and under a similar timeline.

Another area where ML can be applied, is in spend analytics. Expenditure data can be analysed to help procurement departments make better purchasing decisions and improve compliance monitoring. Clustering methods may help to classify items with similar properties together, hence allowing better categorisation of spending patterns. For instance, applying clustering techniques to procurement of services may enable ML to classify cleaning, painting and pest control services under the umbrella of "maintenance services". This can be extended to the "service provider level" based on the logic that similar service providers are likely to provide similar types of services. This will be useful for relevant departments to monitor spending within a category as well as across categories.

The most common ML application for anomaly and fraud detection is unsupervised learning task of clustering. Unsupervised cluster analysis aims to learn patterns from within the data without predicting an outcome. In fraud detection, clustering helps to identify transactions that differ significantly from others (i.e. outliers) and appear suspicious. This is used when there is no prior knowledge of fraud within dataset. Suppose there is another dataset that already has cases of fraud, other ML techniques can be used to identify features that constitute fraud and these same features can be used in a predictive tool that can detect new cases of fraud.

Probabalistic ML methods (incorporating probability theory in making predictions) will always have an element of error in their results but this could be minimised by using larger datasets to train the models. Textual analysis and web crawling could also be adopted to derive information from textual data. The information is then analysed using natural language processing, which further improves the ML model's "vocabulary bank" and better understands context, conditions that are essential to spend analytics.

MACHINE LEARNING KNOWLEDGE AND SKILLSET

Organisations will need access to right technology knowledge and skillsets. Clearly, this starts with technical expertise in ML. But these technical skills will need to be complemented by deep understanding of the business context that surrounds the data and the insight required. Some roles will continue to emphasise technical accounting expertise and human judgement to deal with difficult and novel cases. Other roles may expand to increase collaboration and partnering with other parts of the organisation to help them derive the right meaning from data and models. There will also be new jobs. For example, accountants will need to be involved in training or testing models, or auditing algorithms which may require deep knowledge of ML techniques. In other roles, accountants may just need a more superficial knowledge of ML to be able to have informed conversations with experts and other parts of the business.

Increasingly, more and more accounting work is now done by machines that rely on algorithms to make certain judgement or classification. Going forward, auditors will be engaged to understand algorithms and to provide algorithms assurance services to ensure ML algorithms remain robust and accurate.

With ML, both machine and employee can perform the task at the same time. He or she can have oversight of the operations and achieve greater efficiency at work. Sometimes what we find is that ML algorithms can be great at picking up pervasive but subtle patterns that many people, even experts, gloss over. ML also makes it much easier for professionals to analyse unstructured data such as the text of documents, including contracts, legal documents, accounting filings, press releases, news articles, emails, etc.

For accountants, this does not mean that jobs are getting more difficult; it's simply that what is needed is changing. It is therefore necessary to pick up programming languages for statistical analysis, such as R or Python, SQL for data query, and Spark and Hadoop for big data analytics. For instance, if an accountant needs to prepare a weekly report, where he or she collects data from the same sources and combine the data in the same way each time, this process can be automated in Python or R, such that one command is run and all data work is done.

As ML technology continues to expand in accounting practices, it is important to note the exposure of accounting students to ML will become increasingly urgent. Accounting faculty should move towards integrating ML topics into the accounting curriculum, so that students can start learning about ML before they encounter it in the workplace.

As the Accounting industry begins to realise that education is the key to closing the widening skills gap, there is growing momentum in the upskilling of those currently working in the accounting sector, as well as in the training and hiring of the next generation of accounting professionals. It is hoped that a sustainable talent pool of technologically-adept accounting and financial professionals will certainly emerge.

CASE STUDY: SMU SCHOOL OF ACCOUNTANCY TAKES THE LEAD TO BRIDGE THE TECHNOLOGY SKILLS GAP

The Singapore Management University School of Accountancy (SMU-SOA) aims to develop versatile accounting professionals and business leaders through holistic education, thought leadership, and collaboration with businesses and society. To this end, SMU-SOA places a strong emphasis on the industry-responsiveness of our accountancy curriculum. The majority of the practitioners agreed that data analytics and ML have a vital role to play in the future of accounting. Yet, data scientists often lack domain knowledge in accounting areas, while those with domain knowledge in accounting or business areas lack the technological know-how. The key challenge they faced was to recruit talent who have knowledge in both disciplines.

Therefore, it becomes apparent that educators should take the lead to groom the right talent to meet the current and future demands of the Accounting sector. In August 2018, SMU-SOA launched a suite of accounting data analytics and ML curriculum designed to groom a sustainable talent pool of technologically-adept accounting and financial professionals. In the process of designing its data analytics curriculum, the school consulted its industry partners and placed emphasis on the applicability and currency of their content. Below are three course samples that cover ML knowledge in the accounting data and analytics curriculum.

Course Content Illustration I: Statistical Programming

In this statistical programming course, students acquire knowledge in applying statistical theory for analysing data that is crucial to all four stages of analytics (descriptive, diagnostic, predictive and prescriptive). One of the tools students will learn is R programming.

R is an established open-source statistical programming language containing data analysis packages used in transforming, mapping and visualising data to facilitate advanced analytics techniques such as ML. With accountants handling data that is growing in volume and variety, it is essential for them to harness the power of R in analysing their data as they help organisations make better business decisions. For example, the "financial statements in R (finstr)" package allows for the creation of reproducible financial statement analysis enabling users to store, share, reuse and reproduce results from their analytical work. This helps management accountants to better handle data that are customised to corporate strategy through improved financial reporting.

The "budgeting in R (budgetr)" package also helps users to create budgets easily so as to support the company's finance function. The created budgets and schedules can be replicated and updated using R scripts for automation to ensure that the arduous tasks of doing so can be handled by a machine, thereby freeing up accountants to focus on interpretation of analyses and the application of the results to management action.

Lastly, Activity-Based Costing can also be improved through the use of ML techniques in R to more efficiently trace overheads and assign them appropriately. Optimisation algorithms will be faster at calculating costing ratios and hence enhance costs distribution. The accountant's role then becomes one of interpreting the ML outputs and designing implementation measures for management while also evaluating the ML performance. This will ensure that ML is continually monitored and improved.

Several topics that are covered in this course include basic ML concepts; supervised and unsupervised learning; predictive and prescriptive analytics; unsupervised learning using clustering - optimal clusters, clustering concepts; extending clustering to anomaly detection - point anomalies, cluster anomalies, contextual anomalies and finding outliers.

Course Content Illustration II: Forecasting and Forensic Analytics

In this course, students will gain exposure to techniques to explore how financial and non-financial data are used to forecast events, detect financial discrepancies and frauds, predict corporate default, optimise operations, and determine business strategy. Programming and data visualisation skills will be required to draw insights from large volumes of data. Advanced analytics methods such as text analytics, ML, neural networks and deep learning will also be introduced. This course has been designed to equip students with an analytical mind-set to develop advanced analytics strategies and make better business decisions.

Several topics that are covered in this course include ML and other recent advances in analytics. ML and other analytical models are explored in contexts such as forecasting sales and financial statements; identifying red flags for contracting; predicting default and bankruptcy; and fraud detection.

Course Content Illustration III: Accounting Analytics Capstone Course

The accounting analytics capstone course is a hands-on capstone project represents an opportunity for students to apply what they have learnt in the accounting data and analytics curriculum in a real-world setting. Building on the foundations of statistical models, students adapt them to fit the project cases they are tasked to solve, taking on the role of consultant teams working with their clients to develop forecasting models for inventory, production and product sales planning.

The capstone course operates on a partnership model, where companies can collaborate with SMU school of Accountancy faculty to mentor students in data analytics and ML projects aim to help to solve complex financial analytical problems in a real-world setting.

An example of an accounting analytics capstone project is as follows: a Small and Medium Enterprise (SME) from the food manufacturing industry commissioned a team of five accounting students from the Accounting Analytics Capstone course in January 2018, to build a financial predictive model with both analytical and predictive capabilities. The SME was keen to venture into new and different markets, but lacked sufficient information to proceed, such as operating costs and return-on-investment. With the help of predictive analytics using ML techniques, the company could then calculate the likelihood of success when introducing a new product in a new market, such as identifying the countries with market potential for the specific food item consumption; calculate the start-up costs; the sales volume that would enable the company to break even; the return-on-investment; and even the expected profit following five years of operations. Throughout the project, as consultants to the SME, the student team brainstormed on possible actionable insights and recommendations using the financial model they had developed.

The food manufacturer had been keeping track of more than 40 varieties of food products in different packaging designs and weight. In addition to the various retail packaging formats were the customisations for private labelling, again in different packaging, weight and quantity for different customers, hence resulting in too many SKUs to manage, and also the problem of holding too much raw materials and packaging materials.

Another issue for the food manufacturer was that ideas of venturing into new and different markets had surfaced before, but they did not materialise. The big deterrence to further global expansion was the absence of important supporting information, such as operating costs, return-on-investment, production quantity, and so on. This information was a must to assess the potential risk of investing in different foreign markets, and its absence ultimately determined the overall expansion strategy. Thus a key value proposition of data analytics was that it could help the company to visualise what the future holds, and hence in justifying decisions made.

With the company's historical sales data, the analytical findings revealed seasonal buying patterns by local consumers. It also showed the products which were most responsive during those periods. For instance, a spike in consumer demand was reported during the festive months of December to February every year, which coincided with Christmas, New Year and Chinese New Year celebrations; and which were the most popular food items bought by Singaporeans during this time.

Acting on these patterns, the food manufacturer could now manage the supply chain process more efficiently during the festive period by adjusting the procurement of raw materials, and managing production, marketing, distribution and warehousing suitably to cater to the increased demand.

Using predictive analytics with ML techniques, the company could calculate the likelihood of success when introducing a new product in a new market. The predictive model suggested a few countries that had market potential for the specific food item consumption, and based on the preferred manufacturing quantity, it would also calculate the start-up costs, the sales volume that would enable the company to breakeven, the return-on-investment and the expected profit following five years of operations. The predictive model also helped to quantify the potential reduction in revenue of well-established products upon market introduction of a new product variant under the same family brand.

Projects completed in the Accounting Analytics Capstone course include: developing Excel/Tableau dashboards for financial performance evaluation, inventory planning, and payment and collection cycles reviews; using ML to construct revenue and cash flow predictive modelling; conducting simulation of business scenarios on customer demand and inventory control; developing a balanced scored card encompassing both financial and non-financial performance metrics; exploring impacts of ML and other AI technologies on the effectiveness of audit design process.

CONCLUSION

The accounting industry needs to recognise that AI technologies such as ML, are enabling tools rather than adversaries out to steal jobs. After all, accountants are not mere bean counters susceptible to automation but professionals who provide actionable insights and their professional skepticism is not something a machine can replicate. The growing prevalence of advanced analytical tools and technologies allows business executives to seek timely and relevant data, which enables them to make better business decisions, grow revenue, improve efficiencies, and better manage risk and compliance.

Given the nature of the changing landscape, there is a need for universities to develop teaching pedagogy and learning approach that will prepare students for future economy. The new approach should be student-centred, industry aligned and turn students into active learners that learn how to learn. In order to remain competitive, universities must therefore find ways to attract, engage and sustain relationships with their students by enhancing their learning experience at the university.

The next generation of accounting professionals are expected to possess sound accounting knowledge underscored by a strong proficiency in accounting technologies, and be skilled in communication to be able to interpret and communicate the data effectively to their management and clients. This is the skill set which the SMU-SOA curriculum is designed to groom in our students.

The silver lining behind the 2019 Finance & Accounting Salary Guide by Robert Half was the anticipated surge in remuneration for job candidates who are technologically-adept, demonstrating a strong potential in the accounting sector. Contrary to a common misconception that automation will lead to a decline in the accounting profession, automation and digitalisation will instead lead to growth potential in the accounting sector locally and regionally. This echoed the report by the Committee on the Future Economy (CFE) for Singapore's Working Group on Legal and Accounting Services[1] released in April 2017, which identified accounting as a growth sector for Singapore. The CFE recommended that Singapore should aim to capture international demand for legal and accounting services and become a go-to location for international commercial transactions. This presents tremendous career development opportunities for the accounting professional with the right skill set and mindset towards continuous learning.

1 CFE Singapore. (2017, April 6). Report of the Working Group on Legal and Accounting Services (Rep.). Retrieved https://www.mlaw.gov.sg/content/dam/minlaw/corp/Seminar/CFE-Report of the Working Group on Legal and Accounting Services-Apr2017.pdf

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