

# Deep learning: The next frontier in personalized banking

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**In 1997, a computer crossed a new threshold: Deep Blue, which could consider 200 million positions on a chessboard per second, defeated the reigning world chess champion, Gary Kasparov. In 2017, AlphaZero crossed another threshold by crushing Stockfish, the world champion chess program, scoring 28 wins, 72 draws and zero losses.**

AlphaZero is different. Starting only with the rules of chess, it taught itself an unbeatable strategy without the help of programmers – in 24 hours. Instead of considering every possible move, it focuses only on the most promising positions. In other words, it doesn't simply crunch numbers: it uses "deep learning" to think and learn more like a person, only much, much faster.

Deep learning is a new type of machine learning. It can process a wider range of information – including raw, unstructured data, such as photographs, news stories and handwritten notes. With enough data, deep learning can often produce more accurate results for certain products than traditional machine-learning approaches (for example, the random forest classifier). Interconnected layers of software-based calculators known as "neurons" form a neural network that can ingest and process vast amounts of data through multiple layers that extract increasingly complex features of the data. The network can then use what it has learned to make determinations about new data. For example, once it learns what an object looks like, it can recognize the object from any angle in a new image.

Deep learning is a powerful new tool, but businesses are still learning how to get value from it. We are piloting deep learning techniques in the field of commercial personalization.

# Harnessing deep learning to improve personalization

Personalization helps drive success in retail and commercial banking. It relies on a deep understanding of customers' needs and tailoring offers closely to those needs. A few banks are now using machine learning to improve personalization for certain products. For example, a leading European bank used machine learning at every step of the sales funnel to personalize consumer finance. Its first step, creating "micro-clusters" of consumers who would receive highly targeted value propositions, doubled lift. Step two, choosing specific channels for each offer, boosted redemptions by 50% using a combination of on- and offline channels. The final step, optimizing pricing and volume at granular levels, improved economic value added by 35%.

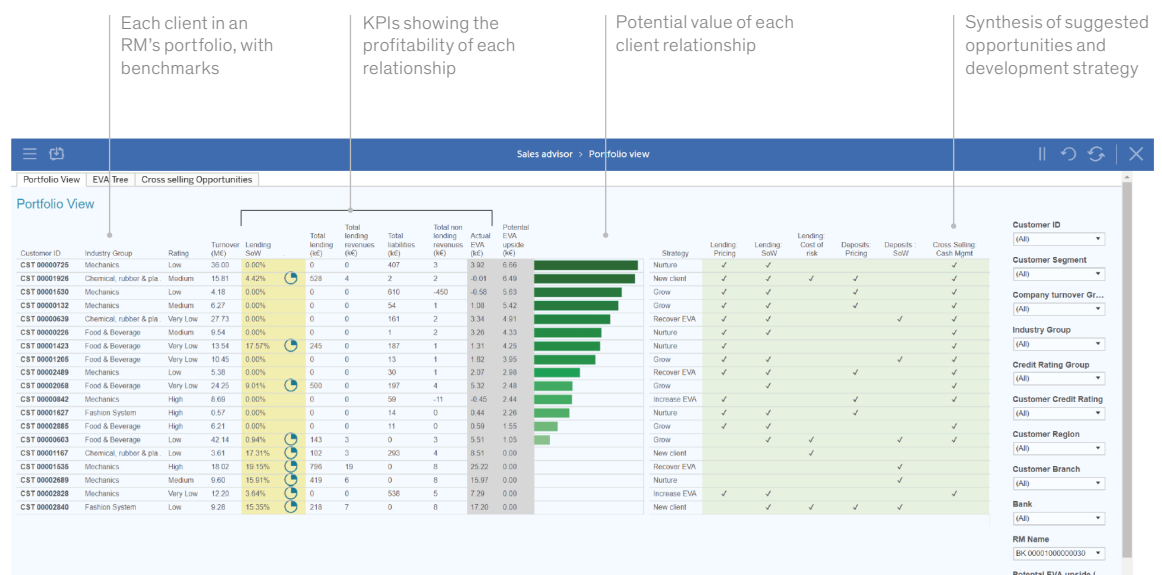
At commercial banks, relationship managers (RMs) tend to focus on their biggest accounts, which rarely offer the biggest growth potential. They may also struggle to find time to use manual CRM tools.

Meanwhile, sales teams may not align on the right targets or divide tasks efficiently across RMs and product specialists.

Machine learning helps them overcome these challenges and adopt personalized approaches. For example, sales teams can use a user-friendly digital dashboard powered by a combination of big data, advanced analytics and input from sales, product and risk experts and other stakeholders. It gives RMs novel customer insights, estimates the potential of each customer and product, and highlights the most profitable sales opportunities. The dashboard shows each RM his or her portfolio of clients ranked according to their potential value – along with recommended strategies for achieving that value using the specific, personalized offers created for each account, as shown in Exhibit 1.

Exhibit 1

## The dashboard ranks each client according to potential value suggest strategies for achieving that value



## Advantages

- Reveals high-potential clients
- Helps RMs prioritize client development activities
- Fosters the use of a consistent value-based metric to steer commercial actions

Incorporating discussions with all relevant stakeholders, the dashboard can also generate and refine concrete sales targets – and track performance against those targets. With a “single source of truth,” team leaders and RMs have a baseline for discussions about performance and how to improve it by incorporating data-based insights and personalization.

To build a dashboard like this, banks generally need to close gaps in internal data, incorporate proprietary and other external data where required, determine benchmarks, and create descriptive and predictive models for each product.

The next level of sophistication – deep learning – can yield even more dramatic advances. Machine learning techniques, while powerful, require clean and engineered data. Deep learning, on the other hand, can use raw structured and unstructured data, and it can scale better across customers and products. As described in the text box, deep learning offers next-product-to-buy predictions that are far more accurate than any other method.

Case example

## How deep learning improves predictive accuracy

A deep learning enhanced matrix factorization system can consider customer features, product features and customer and product interactions in one modeling process. It can learn directly from structured and unstructured data, such as written descriptions of customers and products.

The single tensor incorporating all of this data can be naturally supercharged with deep neural networks, and the model can learn as data is added. Using pointwise or pairwise learning functions, it can make accurate predictions using noisy or incomplete data, such as for share of wallet, where most banks have only a partial view of customers’ behavior and the products they own.

In addition to providing much more accurate predictions, a deep learning model like this can deliver results 40% faster because it requires less data preparation, less feature engineering and fewer product model iterations.

Serving a leading commercial bank in the Asia-Pacific region, we used deep learning to improve the true positive rate (TPR), and perhaps more important, significantly reduced the false positive rate (FPR) for more than half of the products using the same data set, as shown in Exhibit 2. The results showed significant improvement. For example, the new leads were twice as good as the old leads. In other words, while deep learning can’t sell products (at least not yet), it is already helping humans use their time much more wisely.

As the exhibit shows, deep learning does not always outperform machine learning. Teams need to choose the right tools for each kind of analysis. In general, we find that deep learning outperforms where more data is available; with small sample sizes, machine learning may work better. Deep learning helps teams process larger amounts of unstructured data with less effort; machine learning may yield more accurate results with individual data models, but it is not always possible to create individual models for every product.

## Deep learning out performs traditional machine learning

| Product                            | Machine learning |     | Deep learning |     |
|------------------------------------|------------------|-----|---------------|-----|
|                                    | TPR              | FPR | TPR           | FPR |
| Business Lending – Short Term      | 94%              | 10% | 94%           | 4%  |
| Business Lending – EFL             | 81%              | 20% | 92%           | 16% |
| Business Lending – Long Term       | 84%              | 24% | 87%           | 11% |
| Business Lending – Working Capital | 79%              | 34% | 86%           | 9%  |
| Business Transactional             | 75%              | 22% | 87%           | 6%  |
| Business Transactional Accounts    | 75%              | 25% | 78%           | 18% |
| Card Products                      | 87%              | 18% | 92%           | 7%  |
| POS                                | 87%              | 15% | 93%           | 9%  |
| Retail Lending Cash Flow           | 80%              | 17% | 93%           | 10% |
| Wholesale Deposit Products         | 88%              | 11% | 96%           | 3%  |
| Wholesale Products                 | 94%              | 7%  | 97%           | 3%  |
| Retail Transactional               | 73%              | 12% | 76%           | 11% |
| Business Transactional Specialist  | 98%              | 8%  | 88%           | 9%  |
| International Transactional        | 76%              | 25% | 76%           | 24% |
| Trade Finance                      | 75%              | 24% | 63%           | 22% |
| Local Guarantees                   | 77%              | 22% | 62%           | 22% |
| Retail Savings                     | 75%              | 21% | 80%           | 27% |
| Foreign Currency Overdraft         | 89%              | 14% | 87%           | 26% |
| Managed Funds                      | 95%              | 8%  | 88%           | 25% |
| Retail Lending – Long Term         | 85%              | 19% | 79%           | 23% |
| Term Investments                   | 81%              | 7%  | 73%           | 39% |

Deep learning and machine learning systems are incredibly powerful, but maximizing their value requires RMs, sales teams and senior leaders to change the way they think and act.

Pilots can help, since significantly better results can spur salespeople to use the new tools. Senior executives often have to abandon what they might consider conventional wisdom.

# Next steps

We believe every bank should be personalizing product recommendations and commercial approaches. Advances in data science and technology are making it possible to centralize such an effort and support RMs with recommendations that are more relevant and accurate than ever.

Getting started in personalization is easy, and results can come quickly: core elements of RM support can be digitized in three months. “Off-the-shelf” modules include portfolio performance overview, lead generation, an action planner, deal pricing and central tracking and steering.

Our first step is creating a rich data set, typically in the cloud. We then select tools from our “Analytics Garage” to work on the data. We rapidly create, test

and improve prototypes. Once proven prototypes are in hand, we put them to work, eventually linking and upgrading apps to enterprise-class solutions leveraging deep learning technologies. Our multi-client development community shares ideas and insights to make advances more quickly. We have forged seamless strategic partnerships with a wide range of proven providers of marketing ROI, social insights, CX and predictive analytics, who work together to put deep learning to work.

In the 3D chess match of commercial banking, where the stakes are high and competition is fierce, a player needs every edge. Deep learning will give the most innovative banks lasting advantages and help them consistently outperform their peers.

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