CASE STUDY

Financial Services
Machine Learning

China UnionPay takes a proactive approach to risk mitigation

Machine-learning algorithms powered by Intel® technology-based compute clusters replace rules with intelligence.

As an early adopter of an Intel® technology-based intelligent, artificial neural-network risk-control system, China UnionPay has demonstrated the value of using machine learning to drive proactive, highly efficient and accurate risk identification and mitigation workflows. It used a platform based on Cloudera CDH* and Apache Spark* compute clusters to boost accuracy by up to 60 percent.

Challenge

Like financial institutions all over the world, China UnionPay is seeing a significant growth in its transaction volumes. This brings opportunities, but also a corresponding increase in fraud threats and other risks. Its existing risk-control system was rules-based, which limited the agility and speed with which the organization could identify and respond to emerging threats. It needed a more proactive, intelligent way of protecting itself and its customers.

Solution

China UnionPay implemented a neural-network risk-control system based on robust Apache Spark* computing clusters and its open source deep learning library – BigDL, which allowed users to develop their own deep learning applications as standard Spark programs. Powered by Intel technology, the new platform uses machine learning to deliver greater consistency and efficiency while significantly reducing man-hours for user development, deployment and maintenance.

BigDL was chosen as its offered comprehensive end-to-end analytics features within a consolidated Big Data platform, yet can be efficiently scaled out when necessary to support the processing of large volumes of big data.

Results

The organization delivered up to 60 percent greater accuracy versus its rules-based risk-control systems when using the new model. It also realized a 20 percent recall rate, which allowed it to obtain the best training model in mere months. By reducing manual labor and incorporating greater intelligence to its risk-control efforts, China UnionPay empowered its in-house team to spend more time on strategic projects, such as assessing how to apply analytics tools and data science to other areas of its operations.

Business Challenge

The way we bank is changing fast. Transactions can now be carried out over a multitude of channels, including mobile, online and social media. This increasingly complex payment landscape, while bringing greater convenience to consumers, presents a challenge for traditional security models. New transaction types can create loopholes in banking and payment systems that hackers and cyber criminals can exploit. According to a 2016 Lexis Nexis study[1], the number of fraudulent transactions per month and the value of those transactions are both increasing. The report states that mobile transactions accounted for 35 percent of all successful fraud attempts, up from 26 percent in 2015. What's more, the cost of fraud now amounts to 1.47 percent of average income for US merchants.

The situation is the same around the world, and the fraud threat is set to grow in step with the payments industry itself. In China, according to the China Internet Network Information Center (CINIC), the number of mobile payment users reached 358 million by the end of 2015, at a growth rate of 64.5 percent[2]. China UnionPay alone handles up to 20 billion payments each year across these channels.

As strategies of attack evolve over time and risks become increasingly sophisticated, banks and financial institutions alike are under mounting pressure to strengthen, if not develop a more intuitive and intelligent risk-control system. Recent security breaches and reports of fraudulent activities have resulted in greater scrutiny on existing risk control systems by senior management while consumers are less forgiving of any form of banking failures.

Payment institutions have traditionally used pre-configured, rules-based systems to control and eliminate risks. These systems evaluate and mitigate financial institutions' risks by establishing and updating their rule banks based on pre-set user behavior characteristics and previous risk data held in a consolidated database. For example, a financial organization may have a PoS terminal in a small convenience store, which sells mostly affordable perishables. This would mean that small-scale transactions would be considered the norm on a day-to-day basis. A rules-based risk-control system may be set to trigger an alert if an unusually large transaction is attempted, so that it can be verified.

As its transaction volumes grew, its rules-based risk-control system was becoming unsustainable. It required significant investment of time and resource to keep up-to-date, and incurred an unacceptable amount of downtime. It was also unable respond to any emerging threats that were not already covered by rules. The company could no longer afford to take such a reactive approach that relied on its ability to predict future risks.

Ever since the boom in China's banking industry, competition has been intensifying rapidly. Banks are stepping up their business development more aggressively than ever before to vie for a larger market share. As a result, they will inevitably expose themselves to a host of new and fast-evolving risks that will come with these new business opportunities. From a business standpoint, frauds comprise two categories: issuer fraud and user fraud. Issuer frauds include false application fraud, counterfeit card fraud, card-not-present fraud, mail non-receipt card fraud and account takeover. User fraud, on the other hand, typically include merchant cash advance fraud, illegal movement of POS machine, card skimming at a merchant's terminal, transaction forgery, card number testing, malicious shutdown and merchant identity fraud etc.

According to the figures released by the central bank, in 2015 alone, 5.442 billion bank cards were issued and 85.229 billion transactions totalling 669.82 trillion yuan were made. Of this, card fraud rate accounts for 1.99BP (proportion of fraud cash amount in every 10,000 yuan) with card fraud loss coming in at 0.13BP. Based on these numbers, the total amount of card fraud in China in 2015 was a whopping 139.26 billion yuan with losses totalling up to 8.7 billion yuan.

That said, card fraud is as devastating to banks as it is to end-users considering the huge risks and losses it brings. To address this, every financial institution across the world is now scrambling to take active measures to detect card fraud. Currently, most fraud detection systems rely on the traditional, rule-based approach. Rules, or scores as it otherwise known, are either established by experienced fraud detection teams in financial institutions or by means of statistical computation. Before a transaction is approved, it is typically put through a rules-based system to sniff out any form of anomalies. Results obtained from rules-based systems are easier to interpret as they are fixed and only updated periodically. But as fraud becomes increasingly sophisticated, rules-based systems are fast becoming obsolete in their ability to act as effective security barriers for banks and financial institutions.

What is more, with the rapid growth in mobile payment adoption and online businesses, card fraud perpetrators are now starting to redirect their focus towards online transactions. Compared to traditional fraud, frauds involving online payment channels are much harder to detect as they are have less noticeable crime trails and can be extended across multiple channels. Of course, what this means is that fraud or risks, for that matter, can emerge at any point of a consumer's purchasing journey.

To address these risks, banks and financial institutions have to be smarter in the way they tackle fraud by adopting a more intelligent risk detection framework like Neural network systems or machine learning algorithms, which are widely used by organisations like FICO and PayPal to counter card fraud. So far, the results from deploying Neural network-based systems have been incredibly encouraging. And even researchers are also starting to take interest in these neural based systems, a newer form of fraud detection methodology that does not rely on manually-keyed rules but instead, employ cutting-edge machine learning algorithm that is capable of detecting newer variants of fraud and predict risks with greater accuracy.

After an internal assessment, it was clear to China UnionPay that adopting a neural network-based framework would be the most effective approach to tackle risks in the long run. With that in mind, a partnership was formed between China UnionPay National Engineering Laboratory for E-Commerce and E-Payment and a team of IT specialists from Intel to collectively access neural network-based models and examine their fraud detection capabilities by combining each of their respective expertise.

Through Intel, an open source machine learning platform BigDL was introduced to provide assistance with architecture solutions, data modelling, parameters tuning and more.

Solution Summary

Intel engineered an intelligent, artificial neural-network risk-control system based on robust Apache Spark computing clusters, and its web-scale machine learning software, which comes with over 10 TB of training data, 10 billion of training samples and unique features. Unlike traditional risk-control systems, which relies on pre-configured alerts to detect abnormal transactions, the deployed neural-network based risk-control model solution is able to improve the accuracy of risk detection using rich algorithms that identify non-linear patterns in large data sets. Potential anomalies are red-flagged swiftly with the new information automatically updated to the system through machine learning to improve its risk prediction accuracy.

China UnionPay deployed the system with a Cloudera CDH* compute cluster – a single-platform that consolidates and analyzes all types of data, from any channel, within a highly secure environment. The strong performance of Intel® Xeon® processors and the sustained optimization of Apache Spark were key to the successful implementation.

Rule-based risk control model vs Neural-network based risk control model:

Rule-based risk-control model	Neural-network based risk-control model
Reactive: Requires active monitoring by in-house fraud team to review manual review queues. Reject and recalculate thresholds, which will then be codified in a rule.	**Predictive:** Identifies non-linear patterns in large data sets. Flags potential anomalies and automatically updates system with new information to improve risk prediction accuracy.
Rigid: Adopts a binary view of whether the rules criteria are met or not and are unable to adapt to seasonal fluctuations.	**Flexible:** Able to apply machine learning to update its system in tandem with new, evolving risks.
Fixed intelligence: Relies on pre-configured alerts to detect abnormal transactions.	**Scalable Intelligence:** Uses historical data as samples. But is able to swiftly analyse, aggregate and correlate data through machine learning and an evaluation model in real-time to eradicate risks.

Business Results

As an early adopter of the Intel technology-based intelligent, artificial neural-network risk-control system and BigDL, China UnionPay gave itself a competitive advantage while also showing its thought leadership by demonstrating the value of applying machine-learning capabilities within the financial sector. Where rule-based control systems rely on pre-configured alerts to detect abnormal transactions, the China UnionPay's intelligent system uses historical data as samples, using machine learning and an evaluation model that can rapidly analyze, aggregate and correlate data. This helps the neural-network system determine whether a transaction is legal or not in real-time, eradicating risks on the spot.

The Spark architecture supports a large number of intermediate computing units and iterative calculations, which are needed to run neural-network algorithms. Calculations can be cached for future use, improving the system's effectiveness over time. By using the Intel and Apache Spark architecture, China UnionPay was able to deliver up to 60 percent greater accuracy versus its rules-based risk-control systems. It also achieved a 20 percent recall rate, which enabled it to obtain the best training model award. The system also enabled the in-house team to develop valuable insights around how to apply analytical tools and data science practices to its raw data.

Overall, China UnionPay's extensive experience within the financial sector combined with Intel's technological prowess proved to be highly effective in addressing the challenges of its payment systems. Technology will continue to evolve of course, and China UnionPay has a strategic plan to meet future challenges by extending the machine-learning approach to online payments that are still in the trial phase. It will harness data analytics to increase the effectiveness of new methods for strengthening user identification and other critical areas within its banking and settlement system.

Spotlight on China UnionPay

Established in 2002, China UnionPay is an international financial institution based in China and specializing in banking services and payment systems. It is the third-largest payment network in the world, operating in 160 countries across Asia, Europe and America. It is the only interbank network in China that has successfully connected ATMs of different banks across the country. This enables customers and banks to seamlessly perform and process cross-region and cross-border transactions.

Find the solution that is right for your organization. Contact your Intel representative or visit intel.com/FSI

[1] True Cost of Fraud Study 2016: http://www.lexisnexis.com/risk/insights/true-cost-fraud.aspx

[2] Statistical Report on Internet Development in China (Jan 2016): https://cnnic.com.cn/IDR/ReportDownloads/201604/P020160419390562421055.pdf

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