Machine learning has had fruitful applications in finance well before the advent of mobile banking apps, proficient chatbots, or search engines. Given the high volume, accurate historical records, and quantitative nature of the finance world, few industries are better suited for artificial intelligence. There are more uses cases of machine learning in finance than ever before, a trend perpetuated by more accessible computing power and more accessible machine learning tools (such as Google's Tensorflow).

Today, machine learning has come to play an integral role in many parts of the financial ecosystem, from approving loans, to credit scores, to managing assets, and assessing risks. But few technically-savvy financial services professionals have an accurate view of where machine learning can play a role at their companies.

At Emerj, the AI Research and Advisory Company, we work with large financial services firms that want to assess where AI could drive value at their companies. We provide our clients this resource as a foundation for understanding the broad possibilities of machine learning in their industry as part of our more extensive AI Opportunity Landscape service.

In this resource, we explore:

- Current AI Applications in Finance, Banking, and Insurance
- Future Value of Machine Learning in Finance
- Relevant companies operating at the intersection of AI and finance
- Related Emerj executive interviews

Note that this article is intended as an executive overview rather than a granular look at all applications in this field. I've done my best to distill some of the most used and most promising use cases, with reference for your additional investigation.

We'll begin by looking at currently running applications within certain financial institutions:

Current AI Applications in Finance, Banking, and Insurance

Below are examples of machine learning being put to use actively today. Bear in mind that some of these applications leverage multiple AI approaches – not exclusively machine learning.

Portfolio Management

The term “robo-advisor” was essentially unheard-of just five years ago, but it is now commonplace in the financial landscape. The term is misleading and doesn’t involve robots at all. Rather, robo-advisors (companies such as *Betterment*, *Wealthfront*, and others) are algorithms built to calibrate a financial portfolio to the goals and risk tolerance of the user.

Users enter their goals (for example, retiring at age 65 with $250,000.00 in savings), age, income, and current financial assets. The advisor (which would more accurately be referred to as an “allocator”) then spreads investments across asset classes and financial instruments in order to reach the user’s goals.

The system then calibrates to changes in the user’s goals and to real-time changes in the market, aiming always to find the best fit for the user’s original goals. Robo-advisors have gained significant traction with millennial consumers who don’t need a physical advisor to feel comfortable investing, and who are less able to validate the fees paid to human advisors.

Algorithmic Trading

With origins going back to the 1970’s, algorithmic trading (sometimes called “Automated Trading Systems,” which is arguably a more accurate description) involves the use of complex AI systems to make extremely fast trading decisions.

Algorithmic systems often making thousands or millions of trades in a day, hence the term “high-frequency trading” (HFT), which is considered to be a subset of algorithmic trading. Most hedge funds and financial institutions do not openly disclose their AI approaches to trading (for good reason), but it is believed that machine learning and deep learning are playing an increasingly important role in calibrating trading decisions in real time.

There some noted limitations to the exclusive use of machine learning in trading stocks, currencies (ForEx) and commodities, see this Quora thread for a good background on machine learning’s role in HFT today.

Fraud Detection

Combine more accessible computing power, internet becoming more commonly used, and an increasing amount of valuable company data being stored online, and you have a “perfect storm” for data security risk. While previous financial fraud detection systems depended heavily on complex and robust sets of rules, modern fraud detection goes beyond following a checklist of risk factors – it actively learns and calibrates to new potential (or real) security threats.

This is the place of machine learning in finance for fraud – but the same principles hold true for other data security problems. Using machine learning, systems can detect unique activities or behaviors (“anomalies”) and flag them for security teams. The challenge for these systems is to avoid false-positives – situations where “risks” are flagged that were never risks in the first place. Here at Emerj we’ve interviewed half a dozen fraud and security AI executives, all of whom seem convinced that given the incalculably high number of ways that security can be breached, genuinely “learning” systems will be a necessity in the five to ten years ahead.

Loan/Insurance Underwriting

Underwriting could be described as a perfect job for machine learning in finance, and indeed there is a great deal of worry in the industry that machines will replace a large swath of the underwriting positions that exist today (see page 2 of this Ernst & Young executive brief).

Especially at large companies (big banks and publicly traded insurance firms), machine learning algorithms can be trained on millions of examples of consumer data (age, job, marital status) and financial lending or insurance

results, such as whether or not a person defaulted or paid back their loans on time.

The underlying trends that can be assessed with algorithms, and continuously analyzed to detect trends that might influence lending and ensuring into the future (are more and more young people in a certain state getting in car accidents? Are there increasing rates of default among a specific demographic population over the last 15 years)?

These results have a tremendous tangible yield for companies – but at present are primarily reserved for larger companies with the resources to hire data scientists and the massive volumes of past and present data to train their algorithms.

We've compared the AI investments of insurance giants like State Farm, Liberty Mutual, and others – in our complete article on AI insurance applications.

Future Value of Machine Learning in Finance

Some of our readers who work in banking or finance may find it difficult to convince their team members or upper management to consider an AI solution to a current problem within their business. It is important to note that while AI is beginning to create waves of disruption across these industries, not all companies may have the insight required to consider how AI might help them in the future. Some experts, such as Ian Wilson, former head of AI at HSBC, consider this lack of information to be an important challenge to overcome when trying to find the right AI solution. He considers education and innovation to be the most effective ways of disseminating this information to other members of one's business.

We spoke to Wilson about how one can rethink banking as a business in the age of AI on our podcast, *AI in Banking*. When asked about how to encourage banking leadership to move forward with ideas about AI, Wilson said,

"Within your organization you must have an AI function that can educate. … A lot of people when they think about rolling AI into an enterprise or into a bank, they think about it from a technical perspective. For me the number one element for a running AI in a bank is education. That process of flowing out the understanding of what those capabilities can do into the bank to make it

part of the DNA. And so that's where you start enabling these people that have these ideas to realize that now there might be a capability to [manifest them.] …

Innovation becomes a structure through which you can start developing these ideas. A lot of people within each business line may have an idea, but because they're not technical they have no way of knowing how to get the ball rolling. To even test that out and see whether it's feasible. So I think it's also important to have that structure in place … so if you have an idea you can hand it over to a team that knows how to pick it up and test it out."

The applications below are those that we consider promising. Some have relatively active applications today (though not as active as the more established use cases listed above), and others are still relatively nascent.

Customer Service

Chat bots and conversational interfaces are a rapidly expanding area of venture investment and customer service budget (our 2016 AI executive consensus ranked them as the most promising short-term AI consumer application). Companies like Kasisto are already building finance-specific chatbots to help customers ask questions via chat such as "How much did I spend on groceries last month?" and "What was the balance of my personal savings account 60 days ago?"

These assistants have had to be built with robust natural language processing engines as well as reams of finance-specific customer interactions. Banks and financial institutions that allow for such swift querying and interaction might pick up customers from stodgy banks that require people to log onto a traditional online banking portal and do the digging themselves.

This kind of chat (or in the future – voice) experience is not the norm today in banking or finance, but may be a viable option for millions in the coming five years. This application goes beyond machine learning in finance, and is likely to manifest itself as specialized chat bots in a variety of fields and industries.

Security 2.0

Usernames, passwords, and security questions may no longer be the norm for user security in five years. User security in banking and finance is a

particularly high stakes game (you'd probably rather your Facebook login to the world than release your bank account information to a small group of strangers, and for good reason). In addition to anomaly-detection applications like those currently being developed and used in fraud, future security measures might require facial recognition, voice recognition, or other biometric data.

Sentiment/News Analysis

Hedge funds hold their cards tight to their chest, and we can expect to hear very little by way of how sentiment analysis is being used specifically. However, it is supposed that much of the future applications of machine learning will be in understanding social media, news trends, and other data sources, not just stock prices and trades.

The stock market moves in response to myriad human-related factors that have nothing to do with ticker symbols, and the hope is that machine learning will be able to replicate and enhance human "intuition" of financial activity by discovering new trends and telling signals.

Ben Goertzel provides some interesting insight into the world of AI hedge funds in this recent WIRED article. Goertzel shares the belief of many others that machine learning in finance will be far from limited to stock and commodity data – and that the AI hedge funds who come out of top will need to do much more than study ticker symbols alone.

Sales/Recommendations of Financial Products

Applications of automated financial product sales exist today, some of which may not involve machine learning (but rather, other rule-based systems). A robo-advisor might suggest portfolio changes, and there are plenty of insurance recommendation sites this might use some degree of AI to suggest a particular car or home insurance plan. In the future, increasingly personalized and calibrated apps and personal assistants may be perceived (not just by millennials) as more trustworthy, objective, and reliable than in-person advisors.

Just as Amazon and Netflix can recommend books and movies better than any living human "expert," ongoing conversations with financial personal assistants might do the same for financial products, as we see beginning to happen in the insurance industry.

Emerj for Financial Services Companies

Financial services companies use Emerj AI Opportunity Landscapes to pick high ROI projects in areas like lending, fraud detection, anti-money laundering, customer service, and compliance. Our research steers companies toward winning in the marketing by informing them on the best AI vendor solutions for their business problems and helps them avoid costly pilots with AI vendors that are unlikely to deliver a strong ROI. Financial services companies also partner with Emerj to build long-term AI strategies for improving revenue, reducing costs, and mitigating risk in a variety of departments. Contact us to learn more.