

**HYBRID AI/ML MODELS THAT COMBINE THE STRENGTHS OF DIFFERENT ALGORITHMS FOR IMPROVED PERFORMANCE AND EFFICIENCY IN FINANCIAL RISK MANAGEMENT****Rajiv Avacharmal**AI/ML Risk Lead, AI/ML Expert, University of Connecticut, USA  
rajiv.avacharmal@gmail.com**ABSTRACT**

*This report aims to provide a general description of the various methods that can be used for making a hybrid type of Machine Learning or Artificial Intelligence model that will be used for mitigating and finding financial risks. By combining different types of AI and ML technologies it is possible to make newer and latest versions of techniques and tools that can readily assist enthusiasts and professionals [1].*

*Keywords: Artificial Intelligence, Machine Learning, Models, Finance Risk Management, Ai, ML*

**1. INTRODUCTION**

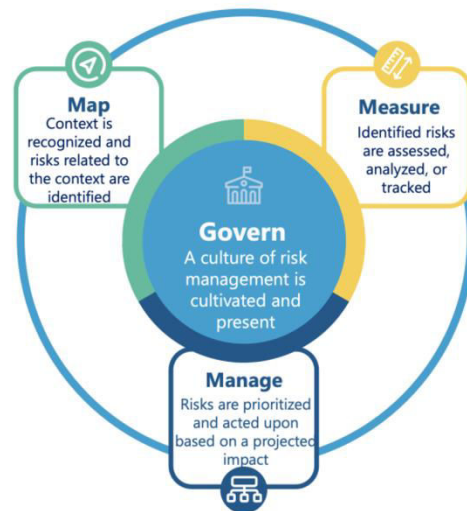
AI/ML models which are technologically advanced are the latest models of financial risk management which are a combination of AI and ML frameworks. These models update the risk evaluation process, risk assessment, and risk management strategies in the financial field [2]. These mixed AI-ML models are an all-inclusive system that is able to perform complex financial data analysis, see the options, and predict risks using the smart learning capabilities of AI and the data processing abilities of ML with basic precision and efficiency [3].

AI/ML hybrid models are sensibly going to be used in the financial scene where there is great speed of change and interconnectivity to evaluate quickly emerging issues, regulatory challenges, and market uncertainties. The models have made advancements in the calculations, complex learning, and data-driven experiences that offer a wide-roamed view on financial situation, better enhance the portfolio management, and strengthen the compliance [4]. Being an integral part of the digital transformation and data-driven approach in the financial industry, hybrid AI/ML models are all set to play the most important role in the development of the risk management techniques and aim to bring about a significant improvement in the face of a volatile economic environment.

**2. OVERVIEW**

The risk management field has been challenged by the advent of Artificial Intelligence (AI) and Machine Learning (ML) as they have ushered machines, and new techniques to identify, foresee, and mitigate risks in various industries like finance, security, healthcare, and organizational prosperity. AIs and ML can manipulate huge amounts of data train models and make decisions based on facts rather than the traditional way [5].

In risk management, AI and ML are viewed as being the most crucial aspect that not only automates important processes, but also robotizes difficult tasks and helps in bringing accuracy in risk assessment. The use of AI-powered intelligent assessment in this regard will be helpful to affiliations as they will be able to see hidden risks, recognize oddities and predict future results with more critical accuracy, which in turn allows for the implementation of proactive risk mitigation systems and informed clever decisions [6].



**Figure 1: Role of AI in Risk Management**

(Source: <https://www.equalai.org/blog/2022/08/10/nist-will-cultivate-trust-in-ai-by-developing-a-framework-for-ai-risk-management/>)

Besides the fact that AI and ML movements are a lot of helpful in fraud detection, credit rating, portfolio optimization, and predictive analysis, they also play a crucial role in the financial industry. These are the grade of progress used to tools that target fake exercises, create financial sustenance, dossier experience portfolios, and by making the process of administrative compliance easier through the transformation of complex datasets into risk alerts.

In the same way, AI and ML assessments can completely change network security management by discovering and identifying digital risks, revealing weaknesses, and designing security shields to protect sensitive data and systems from destructive attacks. AI and ML technologies, employed to break down association traffic, track client direct, and identify any anomaly can complement online safety initiatives as well as help to mitigate the risks associated with a very much connected digital world [7].

**3. CHALLENGES IN TRADITIONAL APPROACHES**

The dynamic and complex business environment of the present days sets few problems for the traditional approaches to risk management. The other problem is the use of manual cycles and the outdated strategies which can end up in the errors of oversights or omissions due to the inadequate risk evaluation and control. Traditional risk management has its own problems that are not accessed often. This is evidenced by the complexity of the work processes, silted data sources, and the manual nature of the data section, which makes it difficult to get and view industrial data effectively.



**Figure 2: Traditional Risk Management**

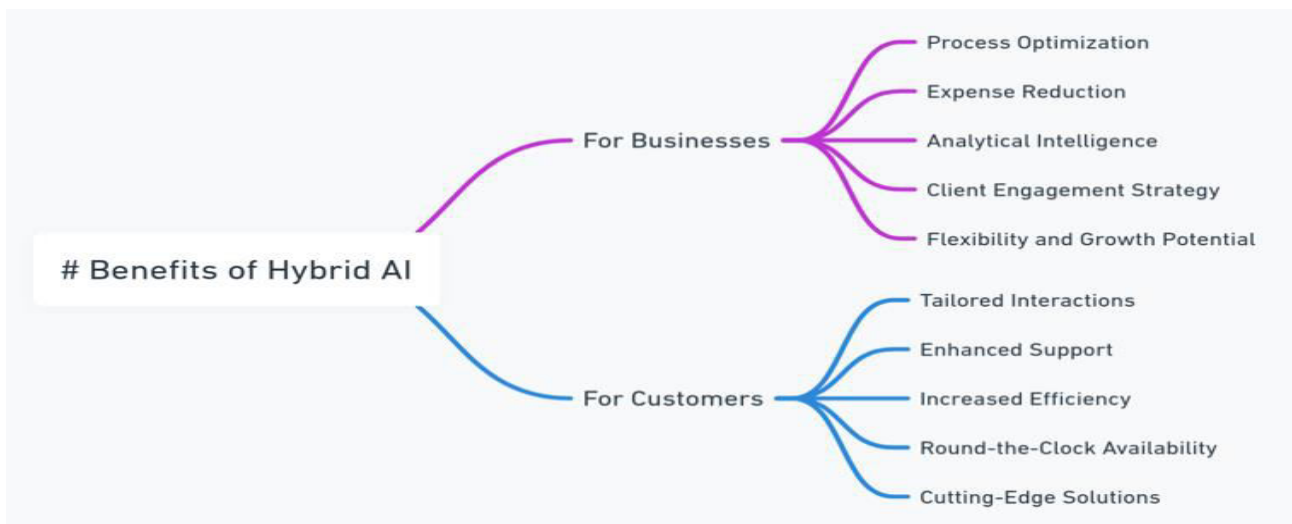
Another test is the insufficientness of the ability of a company to engage and align its risk management boundaries. Siloed risk management accounts for fragmented approach aiming at establishing some levels of communication, data and information sharing between organizations, which might result in isolated risk evaluation and conflicting risk mitigation efforts. These downsides of mix can be the cause of thoughtlessness, duplication of efforts and stunting of the overall risk perception [8].

This arises a new concern where traditional risk management approaches may battle to rapidly assess the environment and attend to the new risks of the day in the present digital era. In contrast with the conventional plan of dealing with risks, the digital age with its administrative changes and overall uncertainties, requires a more agile and responsive strategy for handling risks. Conventional approach cannot be used to fulfill demands of flexibility and promptness that start to handle agile risks.

However, the tradition practice of risk management is more often than not reliant on real data and deterministic models, which may not completely capture uncertainties and complexities that have become common in the modern business environment. The reliance on past data of a straight model can restrict the capacity to envisage and answer the arising risks, the gray swan, and the black swan events, which could significantly impact organizations [9].

#### 4. HYBRID AI/ML MODELS: CONCEPT AND ADVANTAGES

The hybrid AI/ML models put together the characteristics of the artificial intelligence (AI) and the machine learning (ML) techniques to create versatile and flexible answers to complex problems. These models will, as well, control the narrowness of AI, such as thinking, planning, communicating, and decision making. The AI-ML evaluations will be used for correcting plan validation, prudent assessment, and action taking, respectively. With a combination of AI and ML components, the hybrid model would be able to account for a wide range of the needs in the different domains. The model would be equipped with the new features of performance, ability to adapt, and utility.

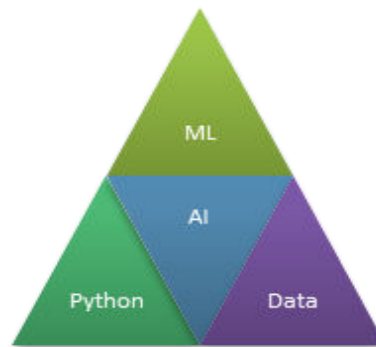


**Figure 3: Benefits of Hybrid AI**

Hybrid AI/ML Models are one of the essential benefits of AI/ML Models, because AI and ML works close together. AI calculations allow the models to work with complicated data structures to follow the complicated decision making process, and adjust to a dynamical environment, while ML models provide them with learning from data, see models, and generate assumptions based on clear models. This supportive power of AI and ML components to produce more accurate, precise, and flexible plans, which is not present in the standalone AI or ML models, is one of the attractive features of the hybrid models [10].

Another advantage of these hybrid AI/ML models is their flexibility and adaptability to the frequent changes that occur in the field of organized attempts. Such models are definitely changeable, and hence, they can be molded in a way to communicate the use cases, integration, and security of AI and ML methodologies, keeping the requirements of the focal problem in mind. When combining various assessments and systems, hybrid models could be used to consider and consequently deal with the intricate and difficult problems that can not be handled by the individual AI or ML approaches. They can actually come up with a holistic approach towards different problems [5].

In addition, it is recognized that hybrid AI/ML models perform along with the interpretability and explainability of the results, allowing the get insights into the fascinating cycle and thinking behind the figures. AI's cognitive ability and ML's data-driven approach together can obtain accurate and simple results which attract the accessories for better recognition of the model's decisions and made intelligent moves relative to the data supplied [7].



**Figure 4: AI/ML Model**

(Source: Self-Created)

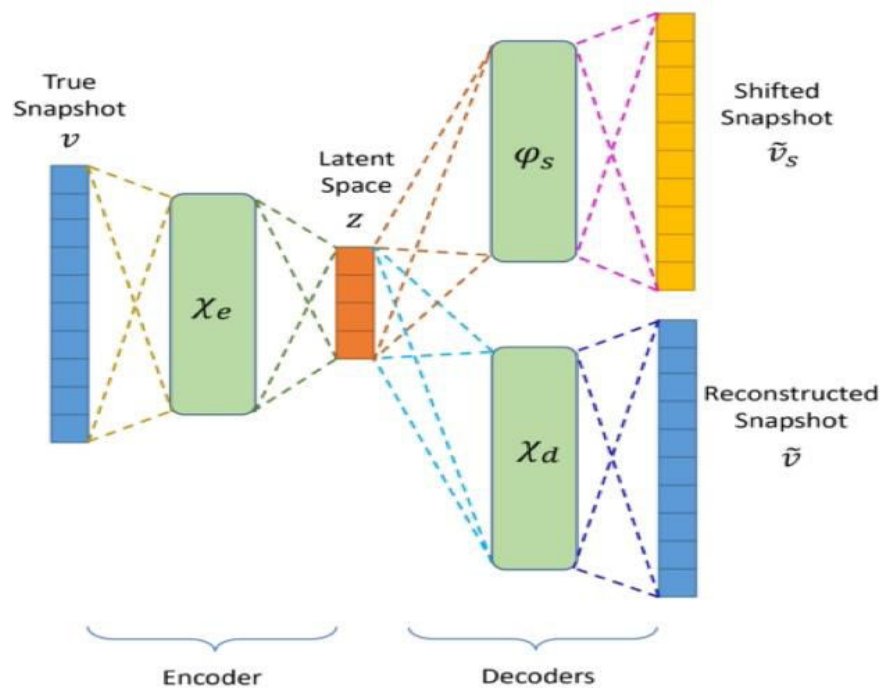
In summary, Hybrid AI/ML models can be considered as a strategic approach to dealing with complex issues that involve combining the strengths of AI and ML systems. Thanks to their versatility, adaptability, and interpretability, these models play a fundamental role in addressing real-world problems; they are tools that forward thinking companies can use to implement the most profound of AI and ML forces in their business activities.

## **5. INTEGRATION OF MULTIPLE ALGORITHMS IN HYBRID MODELS**

Hybrid AI/ML models in the area of financial risk management are now gaining immense popularity because of their ability to pack into one model the features of different machine learning approaches and thus to produce more accurate and effective risk evaluation and corrective systems [1].

A neural network, which usually is capable to identify a non-linear relationship in massive datasets, can be applied to capture flighty financial markets and risky models. Firstly, decision trees show outstanding performance in processing simultaneous patterns; this makes them suitable to be applied in situations that require rule-based risk management. Moreover, the business model includes a practical part which proves data reliability and makes recommended systems part and parcel of the ongoing process.

Merging of the different techniques into a hybrid model starts a more thorough and more comprehensive way of risk surveillance and management. Neural networks can learn of such risks through data and, in addition, the market design while decision trees and business rules can be able to guide in deploying lightning systems and risk response protocols. This mix of the individual data and data driven information is quite significant for the administrators, who can construct frameworks that can fit in dynamic financial scenes and in a way, create the economic conditions.



**Figure 5: Hybrid model of Machine Learning**

(Source: [https://github.com/erdc/aa\\_autoencoder\\_ma](https://github.com/erdc/aa_autoencoder_ma))

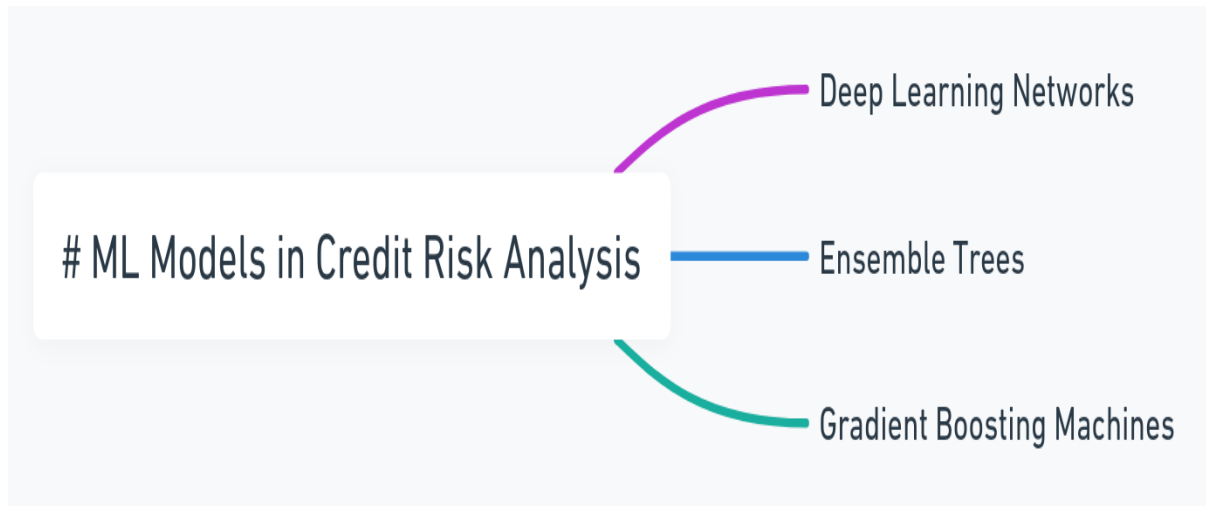
Additionally, in the context of hybrid models, the accuracy factor is a crucial element of the financial risk management concept. With the help of different techniques attributes, the model can remove the drawbacks and hindrances of different assessments of individuals, which enforces more trustworthy and accurate risk estimations. This thoroughness that is further embedded in better taught course is a catalyst for effective and foresighted action through which risks are detected before they become the basis for major financial accidents [9].

The second most important contribution of the hybrid models in financial risk management is to enable the development of the key elements of the core risk management functions and dynamic circles of evaluation that can span the areas of different business. A robust risk evaluation system that takes into account the multiple dimensions and strategic implication of risks is what organizations would rely on to manage the complex risks that cut across different spheres such as operations, markets, and communities [3].

In addition, the fact that the hybrid models depend on new information and changing economic conditions throughout the risk management systems ensures that these risk management systems are always up to date and convincing in spite of the changing financial situations. These dynamic forces are such a valuable element in the present uncertainly changing global economy, where you can suddenly face surprises or difficulties that will change the traditional risk management approaches.

## 6. APPLICATIONS OF HYBRID AI/ML MODELS IN FINANCIAL RISK MANAGEMENT

A hybrid of AI/ML models, which deal with different processes, allows for many AI/ML based financial risk management solutions. Through these attributes and training that are solidifying in neural networks, decision trees, and business procedures, they can further foster risk evaluation accuracy, expect market fluctuations, and improve organizational processes. A comprehensive analysis of different forms of credit risk evaluation, portfolio optimization, and stress testing incorporates important tools for financial institutes in order to understand the complexities of the financial markets and make informed decisions to manage risks and maximize returns.



**Figure 6: Application in credit risk management**

## 7. PERFORMANCE EVALUATION AND COMPARISON

The task of the evaluation and the comparison of hybrid AI/ML models that integrate various assessment examples and contribute to the operational efficiency of financial risk management. Consequently, through the evaluation of precision, usefulness and flexibility of these models in relation to the conventional methods, organisations can settle on the suitability of using hybrid models in risk mitigation. Through the method of executing assessment assessment, the kind and impediments of hybrid AI/ML models can be fractured down to the standard models. By that, the huge pieces of data can be separated and the attributes and obstructions of each model can be analyzed. It is useful for risk management frameworks in the financial district [4].

## 8. BENEFITS AND LIMITATIONS

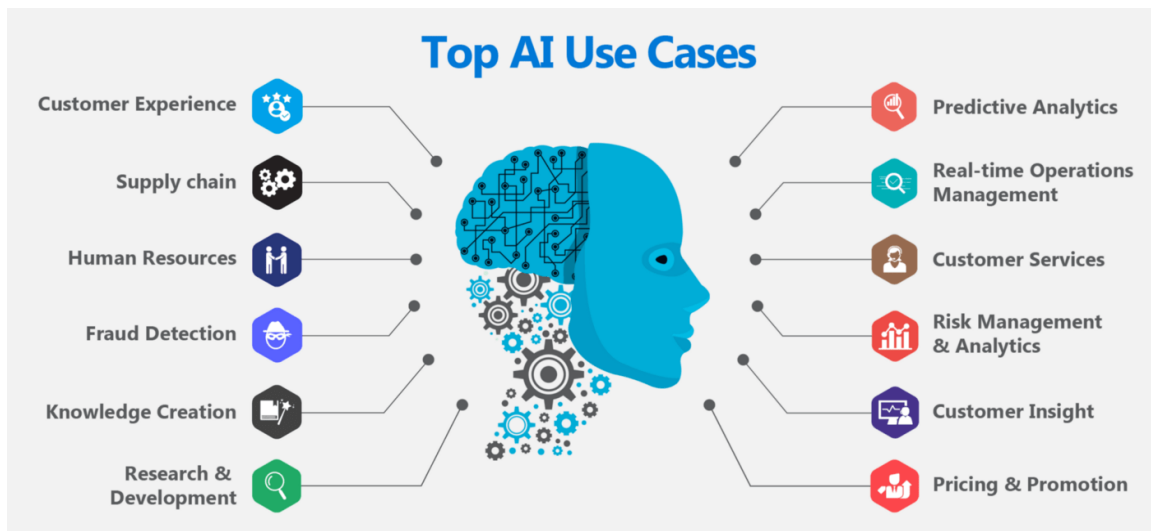
AI/ML hybrid models combining both structured and unstructured calculations provide exceptional speed and efficiency in financial risk management. Merits can be summarized and on the other hand we have the areas where accuracy cannot be achieved, and it depends on the complexity of the risk conditions. Such models are the basis of these models and can lead to more precise evaluations and can provide general tips on how to approach risk and balance. Moreover, with its advantages it also brings difficulties such as complications, difficulties in model interpretation, and possibly coordination issues. One should be aware that introducing new advantages that come with the adoption of hybrid AI/ML models should be cautiously balanced with the fact that such models are complex to plan and interpret.

## 9. FUTURE TRENDS AND OPPORTUNITIES

The future of the hybrid of AI/ML models in financial risk management raises hopes rather than knocks on the door. The latest AI techniques, for example, deep learning and reinforcement learning, will also act on the horizon in terms of and risk prediction accuracy of these hybrid models. Various doors open in the use of gathered information resources, consistent visualization, and explainable AI to trigger risk mitigation systems. The mix of articulation in blockchain and quantum calculation may also turn the risk management works, giving new ways for the improved performance, agility and automation in the financial market [5].

## 10. RECOMMENDATIONS

The Interest in ML Social event: Monetary affiliations is the event based on the ai model that has been used in making the software ought to focus on interest in a mixture of ML models to additionally foster gambling the board limits. This solidifies appointing assets for examination, improvement, and execution of these best-in-class advancements. Relentless Preparation and Fitness Movement, affiliations need to put resources into preparing dares to outfit workers with the critical abilities to really use multi purpose ML models [1].



**Figure 7: Top AI use cases**

(Source: <https://medium.com/@bukunmibabs/using-ai-in-financial-risk-management-5e07e96af549>)

The guide to make these models has all the features that can be added in the development and also in the development that can be increased in many ways. This guarantees that staff individuals can include the best furthest reaches of these movements in risk the board processes. The data sphere purpose that can be added in making the regional development and also in the regional area of the ml model that can be added in the region of the model areas. The ai that can be added in making the model more regressive in nature are also integrated in the development of the serial analysis. Data sharing and joint effort: Enabling collaboration among various divisions and organizations encourages the sharing of data and advances best practices in creamer PC-based knowledge/ML collection.

This accommodating strategy can incite innovative game plans and further risk the pioneer's systems. Standard Evaluation and Overhaul: Hybrid man-made knowledge/ML models ought to be surveyed every time to recognize areas for improvement and confirm their ampleness in tending to develop bets. Affiliations ought to fan out processes for standard survey and refinement of these models thinking about execution assessments and examination. The standard basis of the development that can be added in making the reliable natural development more specific in nature are also consistent with the help of the ai model. The future development that can be added in the existing ai model has many getaways like the cutting edge camera or cutting edge medical technology for the advancement of that technology for better perfection of the technology.

## 11. CONCLUSION

In conclusion it can be said that the overall development of the analytical area of the AI has been shown in the report and proper implementation of the software has been shown in the report as well. The area that can be added in the development analysis has been shown that can be added in the reusability factor also. Overall, the board's financial investment has made a significant leap forward with the combination of half-breed artificial intelligence/ML models. These example-setting progressions offer unmatched limits in isolating complex information, expecting gambles, and illuminating key courses. Associations can work on their chief preparation, smooth out cycles, and better locate the difficulties of the ongoing exceptional business environment by putting resources into mutt ML gathering. In any case, convincing execution requires an assurance of constant preparation, formed effort, and moral contemplations. Cross-variation reproduced knowledge/ML models have the potential to agitate risk the board and drive practical improvement in the financial industry if approached appropriately.

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