European Journal of AI, Computing & Informatics

Vol. 1 No. 4 2025

Review **Open Access**

The Challenges and Opportunities of Leading an AI ML Team in a Startup

Hongjun Wu [1,*]

[1] Department of AI/ML, Bullpen Labs, Inc., New York, NY 10044, USA
* Correspondence: Hongjun Wu, Department of AI/ML, Bullpen Labs, Inc., New York, NY 10044, USA

Abstract: With the rapid development of artificial intelligence (AI) and machine learning (ML) technology, many startups have taken it as an important means of competition. But under the leadership of a startup, AI/ML teams face specific challenges and opportunities. This article focuses on the key concepts, challenges, and possible opportunities of leading an AI/ML team in a startup. First, starting from the basic description of artificial intelligence and machine learning technology, it analyzes the organizational structure of machine learning team of startup companies and the core capabilities that leaders must have. Second, it analyzes the challenges brought about by insufficient resources, insufficient skills and technological change. Third, take advantage of the opportunities presented by technological change, data-driven decision making and attracting investment.

Keywords: AI/ML team; a start-up company; technological innovation

Received: 11 November 2025
Revised: 29 November 2025
Accepted: 12 December 2025
Published: 13 December 2025

1. Introduction

In today's digital age, AI and ML technologies have become important engines to drive enterprise development. Especially for startups, AI/ML can not only bring differentiation to an enterprise's goods or services, but also improve business strategy from data. However, in the process of AI/ML team management in startup companies, problems such as lack of resources, technology iteration, and insufficient manpower are often encountered. How to manage the team efficiently, overcome difficulties and seize opportunities is the key factor that determines its life and death. This article will provide a detailed analysis of the challenges and opportunities faced by AI/ML team leaders in startups, and suggest strategies that entrepreneurs and managers can follow.

2. Conceptual Framework for Leading an AI/ML Team

2.1. Basic Concepts of AI and ML

Artificial intelligence (AI) is a technology that mimics the functions of the human brain and aims to enable computers to perform tasks such as sensory cognition, learning ability, logical thinking, and decision making. Machine learning (ML) is an important field of AI, which refers to the use of data and algorithms to allow computers to learn to improve their own performance, without the need for specially written program code. This learning process includes different strategies such as supervised learning, unsupervised learning, and reinforcement learning, the most important of which is the way to train the model through labeled data, while also using unlabeled data to dig hidden rules [1]. With the growth of data scale and computing power, deep learning is considered an advanced machine learning technique, which has achieved great success in

areas such as image recognition and natural language processing. The commercialization of AI and ML technologies is transforming industries and driving digital transformation. Continuous innovation has also created more business opportunities for them, enabling these technologies to optimize workflow while bringing more economic value.

2.2. AI/ML Team Structure in Startups

Startup AI/ML teams are generally simplified team structures, with distinct lines in each department. Core roles include data scientists, machine learning engineers, data engineers, and AI product managers [2]. Among them, data scientists are mainly responsible for digging information from the data and drawing up the data analysis plan; Machine learning engineers are mainly responsible for building and upgrading machine learning models to ensure the efficiency and scalability of their applications; Data engineers focus on data cleaning, transformation and storage to ensure data quality and availability. Finally, AI product managers cooperate with all lines of communication and cooperation to ensure that scientific and technological research can connect with the market and do a good job in product marketing. Due to the limited resources of start-up companies, employees are often required to do several jobs. In this state, employees need to have strong coordination and communication skills, but also have excellent work efficiency to keep pace with the rapidly changing market and technology [3].

Figure 1 illustrates the complex structure of an AI/ML team in a startup, covering all levels of roles from executive management to technical implementation. Executive management is responsible for strategic decisions, and AI product managers coordinate technology development with market requirements. Data scientists, machine learning engineers and data engineers collaborate on data analysis and model development, while technical support staff and software engineers ensure the smooth operation of the technology platform and the product landing [4].

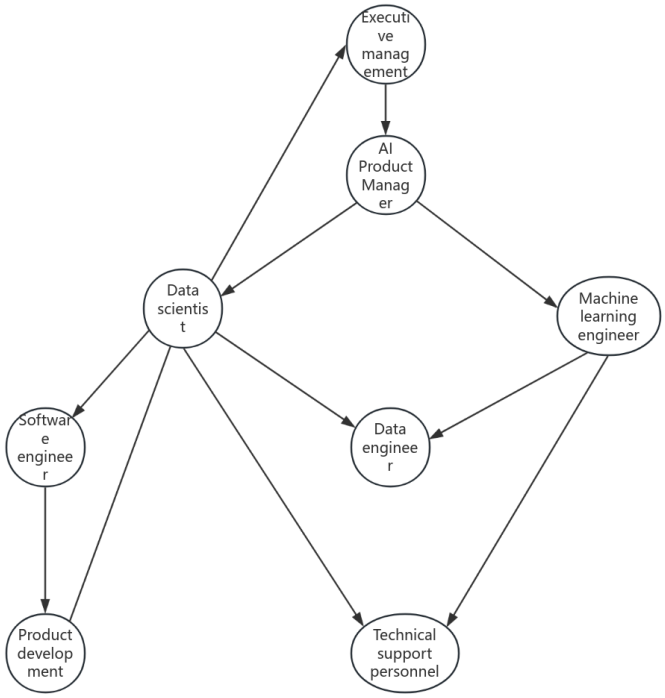

Figure 1. AI/ML team structure diagram.

2.3. Core Skills and Qualities to Lead an AI/ML Team

AI/ML team leaders need to possess the following key competencies. First, a solid foundation requires the accumulation of machine learning, data analysis, algorithms and other aspects to ensure that it can effectively guide the technical path in the field of artificial intelligence. Second, have strategic thinking, can combine scientific and technological innovation with enterprise development strategy, help the team to identify potential opportunities; Third, effective communication skills, especially in department collaboration, can help the team to maintain effective communication, interaction and cooperation to solve problems; Fourth, decision-making ability and ability to withstand pressure, in the rapid development of science and technology, the market competition is very fierce environment with the ability to judge and solve problems; Fifth, the motivation and talent management of team employees is an essential responsibility of leaders, cultivating the ability and creativity of team members to ensure the efficient operation and high-quality development of the team [5].

Table 1 summarizes the key skills and qualities required to lead an AI/ML team, including technical competence, strategic vision, communication and coordination, decision making, stress management, and team management and motivation. These skills help leaders drive technological innovation in complex environments, optimize team collaboration, and ensure that teams successfully meet challenges and operate efficiently in a rapidly changing market.

Table 1. Core skills and qualities for leading an AI/ML team.

Core skills and qualities	Description
Technical capability	In-depth understanding of AI/ML technology principles and applications to guide technical decisions.
Strategic vision	Be able to identify market opportunities and align technology development with business objectives to drive company growth.
Communication and coordination skills	Able to coordinate effectively within the team and with other departments to ensure the flow of information and the smooth completion of tasks.
Decision making ability and stress management ability	Make sound decisions and manage team stress in a complex and rapidly changing environment.
Team management and motivation ability	Effectively cultivate the ability of team members, encourage innovation, and maintain team vitality and cooperation.

3. Challenges for AI/ML Teams in Startups

3.1. Insufficient Resources and Technical Bottlenecks

For startups, the main obstacles and challenges facing the AI/ML team are lack of funding, shortage of personnel, lack of access to data, and lack of basic physical equipment. In order to further understand the impact of these impeding factors on the work effect of AI/ML teams, we can establish mathematical models to quantitatively analyze the impact of these factors on the work effect of AI/ML teams. Suppose that the team's productivity E can be expressed by the following formula:

$$E = \frac{T \times Q}{C + R} \quad (1)$$

Where: T is the technical competence of the team, usually related to the experience and skill level of the team members. Q is the quality requirements of the project, i.e. the complexity of the model or the requirements of the data. C is the team's resource constraints, which mainly include budget and computing power. R is the impact of a technical bottleneck, which usually refers to data quality issues, algorithmic limitations, or infrastructure issues. From this formula, it can be seen that when resource limit C or technical bottleneck R is large, team efficiency E will decrease significantly. This suggests that AI/ML teams, faced with resource shortages and technical limitations, may not be able to achieve the desired work effect, affecting project progress.

3.2. Team Building and Skill Gap

Startups in AI and machine learning teams often suffer from unbalanced staffing and mismatched skills, as a result of startup funding shortages, employees' skills often do not meet the needs of the project. This may be due to the knowledge and technology gaps generated by different positions, such as data analyst, machine learning engineer, data engineer, etc., which reduces team efficiency. In particular, the rapid progress of science and technology such as machine learning, and the difference in technical capabilities and tools within the team is large, the work efficiency of the whole team will also decline. As for how to improve the ability and quality of the team, the team can use external training, self-learning, side by side and other ways, but it will also lead to cost increase and time expenditure and other problems; At the same time, startups have a relatively simple organizational relationship and no clear career path, which also leads to a high turnover rate, exacerbating the problem of skills gap and team stability.

Table 2 analyzes common skills gaps in AI/ML teams and how to address them. What data scientists lack in practical experience with machine learning needs to be made up by training or bringing in experts. Machine learning engineers need to keep up with the latest technology and improve their capabilities through tool updates and regular learning. Data engineers need to strengthen their data processing skills, which can be compensated for by increasing staffing and training. AI product managers have insufficient technical background and need to hire technical product managers or provide training.

Table 2. Skill gap analysis of AI/ML teams.

CHARACTERS	Skills gap	Solution measure
Data scientist	Lack of practical experience in machine learning	Provide training and bring in experienced experts
Machine learning engineer	Not familiar with the latest tools and technologies	Introduce the latest technical tools for regular learning
Data engineer	Insufficient data processing capacity	Increase the number of data engineers and strengthen data processing training
AI Product Manager	Lack of technical background to understand concepts such as deep learning	Hire a product manager with technical background or provide technical training

3.3. Rapidly Changing Technology and Market Pressures

Rapid changes in technology, especially emerging AI/ML technologies such as deep learning and reinforcement learning, put pressure on startups to adapt to technological change in a relatively short period of time to retain their advantages. In addition, market needs continue to change, and technological change requires them to have the ability to meet customer needs in addition to leading technology. In this case, AI/ML teams not only have to continuously improve their technical capabilities, but also have to respond to changes in the market at any time, which brings challenges to their technical route

selection and product development. In addition, most startups have to develop products within the time frame and quickly adapt to customer feedback, placing further demands on their operational capabilities and agility. Rapid technological changes and market changes will cause them to fail to achieve long-term goals in a relatively short period of time, increasing the uncertainty of the company's future.

Figure 2 shows the area of overlap between technological changes and market pressures and their combined impact on AI/ML teams.

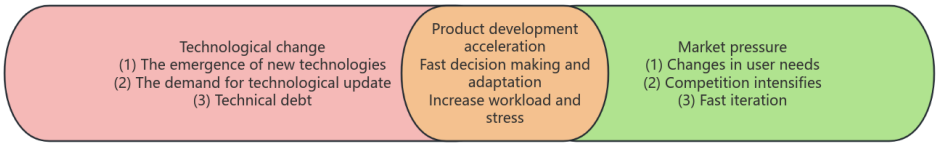

Figure 2. Venn chart of technological change and market pressure.

Technological change includes the emergence of new technology, the need for technological renewal and technical debt. Market pressures include changing user needs, increasing competition, and rapid iteration. The intersection highlights how technological change and market pressures are working together to accelerate product development, require rapid decision making and adaptation, and lead to increased workloads and stress for teams. The Venn chart clearly shows how the two aspects of technology and market are intertwined and have a profound impact on team decision making and execution.

4. Opportunities for AI/ML Teams in Startups

4.1. Technological Innovation Drives Competitive Advantage

For startups, the ability to innovate through the use of AI/ML technology is the main source of their success in the market, allowing them to create new products and services that fill the gaps between existing technologies and products to meet consumer market needs. For example, due to the success of deep learning, image recognition, voice recognition and natural language understanding have been unprecedented development, which also brings a possibility for entrepreneurs to use its advanced nature in their own products. The biggest advantage of startups is adaptability and adaptability. They can make adjustments in the first time according to market changes and use new technologies to increase their market share. Technological innovation drives the company through changes in product functionality, technology, and user experience. It can enhance its technological advantages by applying artificial intelligence and machine learning, and maintain its leading position in the industry by reducing operational costs, improving work efficiency, and improving customer demand. For startups, the use of the above technologies can gain the attention of investors in the market in a very short period of time, promoting the company to create a leading edge. For example, AI-led highly personalized recommendations have increased the competitiveness of e-commerce and social networking sites. Through the analysis of customer data, AI can predict customer needs and push more personalized services to them, thereby increasing customer loyalty and increasing sales, bringing a more stable revenue source for enterprises.

Figure 3 shows how technological innovation drives competitive advantage. Technology innovation drives companies to stand out in the market through new technology applications, technology optimization and product innovation. Technical leadership builds brand influence for the company and further consolidates its position in the industry. These factors interact to promote the company's continuous growth and enhance market competitiveness.

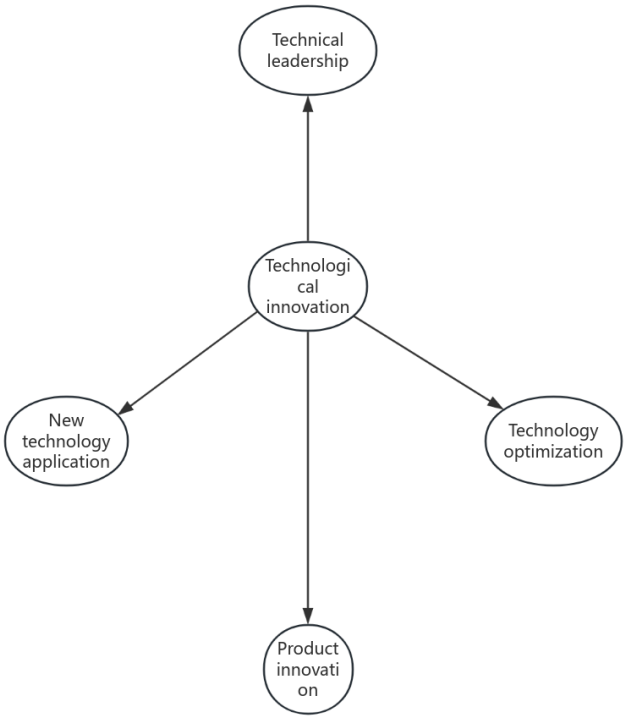

Figure 3. Technological innovation drives competitive advantage.

4.2. Data-Driven Decision Making and Efficiency Improvement

Data-driven decision-making is one of the necessary means for startups to cope with market competition. Through deep mining of big data, AI/ML teams can find potential market development direction, consumer demand, development space and product improvement space, make more accurate decisions, and help startups optimize resource allocation, improve quality and optimize operational efficiency. Assuming that the company's overall efficiency E is positively affected by decision quality D and data quality Q, and is also affected by resource limitation R, it can be expressed by the following formula:

$$E = \frac{D \times Q}{R} \tag{2}$$

Where: E represents the overall efficiency of the company; D represents the quality of decision making, affecting the direction of the company's operation; Q stands for data quality, ensuring decisions are based on accurate and sufficient data; R is for resource constraints, usually referring to a company's people, money, and time.

By continuously improving decision making and improving data quality, startups can achieve greater overall benefits with less investment. Data-driven decision making not only helps improve business operational efficiency, but also helps organizations maintain business flexibility to maintain a competitive advantage in a changing market. Especially in the field of AI/ML tools, data quality and decision accuracy play a key role in product development, marketing, and customer relationship management. At the same time, data-driven decisions can optimize a company's inefficiencies and assist in increasing product and service flexibility. Through the application of data model, we can more efficiently capture and respond to market demand, modify product business planning in time, and gain an advantage in the fierce industry competition.

4.3. Attract Investment and Industry Cooperation Opportunities

The breakthrough and application of AI/ML technology will bring huge amounts of financing to startups and opportunities for industry cooperation. Investors tend to favor

companies with cutting-edge technology and new product concepts. Especially for companies in the AI/ML industry, technology gives them a market advantage, so technology is an important factor in attracting capital. Investors prefer companies that master cutting-edge technology because they are more profitable. In addition, market demand is also one of the factors considered by investors. When the market needs a particular technology or product, investors will be encouraged to invest capital to support the company to meet the market demand. Market demand makes the company's products widely popular, but also enables the company to get more customers and occupy more market share. Whether the founder has set up an efficient team of experts, and whether it can help the company carry out technical research, improve product standards, expand market coverage to enhance the conviction of investors. The founder's scientific and technological innovation ability and its potential business prospects have also been valued by investors. Through collaborative research and development and cooperative marketing with industry partners, startups can quickly bring research and development results to the market and form a certain market advantage.

Figure 4 shows the main factors that attract investment and industry partnership opportunities, as follows: Technology innovation (40%): Technology innovation is the core of attracting investment, and investors generally prefer to invest in companies with cutting-edge technology applications. Market demand (30%): Market demand drives increased demand for products and influences investor interest. Team capability (20%): The execution ability and technical strength of the team are important factors in investor decision making. Commercialization potential (10%): The marketability of a company's technology directly affects its long-term development and investment attractiveness. Together, these factors drive startups to attract external funding and industry collaboration opportunities, accelerating technology development and market expansion.

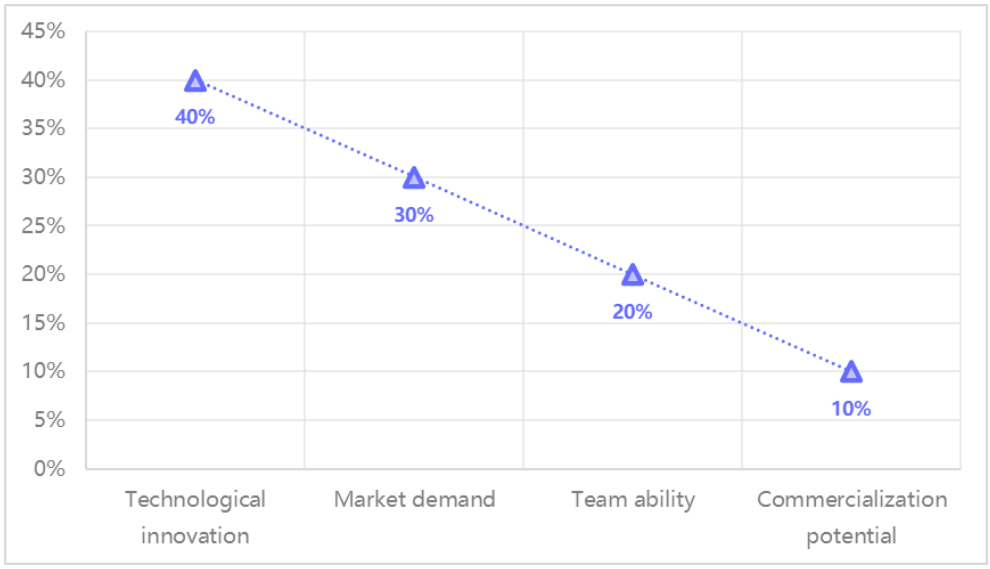

Figure 4. Proportion of factors that attract investment and industry cooperation opportunities.

5. Conclusion

For startups, building their own AI/ML team is both a challenge and an opportunity. The biggest challenges are limited staff/resources and technical challenges, so leaders need to have a deep technical background and ability to manage the challenges they face. However, the rapid advancement of AI/ML technology presents many opportunities for startups to leverage their technological advancements to make data-based decisions and leverage outside investors and partners to make technology investments to bring their products to market as quickly as possible. A good AI/ML team can make significant innovations in terms of technology and business models that differentiate it from other

startups to gain competitiveness in new markets; Despite some challenges, if the founder remains sharp in the face of challenges and can seize opportunities, it can help the rapid development of the startup and lay a solid foundation for its continued success.

References

1. A. Owen, "Future Trends in Machine Learning for ASIC Verification and AI Acceleration," 2023.
2. D. Ireland, "Musings, Ideas and Possible Insights From Behavioral and Complexity Economics And Their Implications for Legal and Regulatory Regimes in Artificial Intelligence/Machine Learning (AI/ML) Digital Space and the Post-COVID World," *Machine Learning (AI/ML) Digital Space and the Post-COVID World (March 12, 2025)*, 2025.
3. C. P. Leão, V. Silva, and S. Costa, "Exploring the intersection of ergonomics, design thinking, and AI/ML in design innovation," *Applied System Innovation*, vol. 7, no. 4, p. 65, 2024. doi: 10.3390/asi7040065
4. S. Moustakidis, S. Plakias, C. Kokkotis, T. Tsatalas, and D. Tsaopoulos, "Predicting football team performance with explainable ai: Leveraging shap to identify key team-level performance metrics," *Future Internet*, vol. 15, no. 5, p. 174, 2023. doi: 10.3390/fi15050174
5. P. Majumder, and H. Groenevelt, "Competition in remanufacturing," *Production and operations management*, vol. 10, no. 2, pp. 125-141, 2001.