

The impact of using artificial intelligence in supporting financial institutions

أثر استخدام الذكاء الاصطناعي في دعم المؤسسات المالية

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Abstract:

The study aims to identify artificial intelligence applications and their contribution to improving the performance of the financial sector in general and electronic banking services in particular. The study highlights the importance of artificial intelligence as an urgent necessity in the financial and banking sector, and to identify the challenges facing financial institutions when implementing it. Using an analytical approach, we concluded that artificial intelligence has an influential role in the financial services industry in gaining competitive intelligence. It has proven its ability to improve internal banking operations, efficiency, accuracy, and decision-making ability through automation, in addition to achieving numerous advantages in the field of trading, asset management, risk management and forecasting, fraud detection, and providing security.

Keywords: Artificial Intelligence, Financial Sector, Risk Management, Fraud Detection, Algorithmic Trading.

JEL Classification: G1 ; G2 ; G3 ; G4

الملخص:

تهدف الدراسة إلى التعرف على تطبيقات الذكاء الاصطناعي ومساهمتها في تحسين أداء القطاع المالي بشكل عام والخدمات المصرفية الإلكترونية بشكل خاص، حيث تبرز الدراسة أهمية الذكاء الاصطناعي كضرورة ملحة في القطاع المالي والمصرفي، والتعرف على التحديات التي تواجهها المؤسسات المالية عند تطبيقه. وباستخدام المنهج التحليلي، خلصنا إلى أن الذكاء الاصطناعي له دور مؤثر في صناعة الخدمات المالية لاكتساب الذكاء التنافسي، حيث أثبت قدرته على تحسين العمليات المصرفية الداخلية والكفاءة والدقة والقدرة على اتخاذ القرار من خلال الأتمتة، بالإضافة إلى تحقيقه لمزايا عديدة في مجال التداول وإدارة الأصول وإدارة المخاطر والتنبؤ بها واكتشاف الاحتيال وتوفير الأمن

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الكلمات المفتاحية: ذكاء اصطناعي، قطاع مالي، إدارة المخاطر، كشف الاحتيال، تداول خوارزمي

1. Introduction

With the advancement of information technology and the explosion in data volume resulting from digital transformation, electronic services, and smart systems, the need has emerged to utilize this data and leverage artificial intelligence, a technology that mimics human behavior in thinking, problem-solving, learning, handling complex tasks, and making decisions. The use of its techniques has become increasingly widespread in all fields and industries, extending to the financial field, as a result of the expertise, experiments, and research of many thinkers and researchers.

In our current era, artificial intelligence in financial management has become an essential element for achieving success and sustainability for institutions. With the increasing complexity of markets and the growing volume of data, artificial intelligence contributes to enhancing the ability of institutions to make accurate and rapid financial decisions. By using advanced analytical techniques, AI can identify hidden patterns in financial data, enabling accurate predictions and improvements in future forecasts. Additionally, AI in financial management helps automate many routine processes, reducing human errors and increasing operational efficiency.

Although there are challenges associated with data quality and transparency, the benefits of artificial intelligence in financial and risk management are undeniable. Thanks to this advanced technology, organizations can achieve a competitive advantage in the market and adapt to changes quickly and effectively, ensuring their survival and growth in an ever-changing business environment.

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Therefore, understanding the relationship between artificial intelligence, markets, and financial institutions is essential to achieving stability in the financial sector, which leads us to pose the following question:

How do AI applications contribute to improving the financial sector? What are the most prominent challenges financial institutions face when using AI? And how can they be overcome?

Importance of the study:

This study derives its importance from two aspects:

Scientific aspect:

The topic of artificial intelligence is relatively new, especially in the financial field, and there is little research on this topic.

Practical aspect:

The importance of this study lies in its understanding of the developments witnessed in the application of artificial intelligence technologies in the financial sector, and how it contributes to enhancing the performance of financial institutions and improving the quality of products and services provided to customers.

Study objectives:

Through this research, we seek to examine the most important and recent developments in the financial sector and highlight the contribution of artificial intelligence to improving this sector. While transactions in the financial sector were previously conducted in a traditional manner and took a long time to complete, they are now completed with just a few clicks on a computer or mobile phone. This is due to the development of artificial intelligence in the financial field. We also seek to understand the importance of artificial intelligence technologies in enhancing the financial sector.

Previous studies:

Whitney Hunt study in 2020 entitled:

Artificial Intelligence's Role in Finance and How Financial Companies are Leveraging the Technology to Their Advantage.

This study aimed to define artificial intelligence and better define its role in financial markets. It focused on discussing subsets of artificial intelligence and how machines learn, as well as its advantages and disadvantages and role in financial analysis. The study also included a comprehensive explanation of the importance of artificial intelligence and its future.

CAO LONGBING's 2021 study: "AI in Finance: Challenges, Techniques, and Opportunities"

It aims to provide a comprehensive picture of economics and finance, as well as the enormous challenges, technologies, and opportunities of AI research in finance over the past decades. The challenges facing institutions and financial data were addressed, followed by a comprehensive classification and overview of decades of AI research in finance. This study also included an explanation of data-driven analytics, business learning, and financial data.

In addition to comparing, critiquing, and discussing classical versus modern AI techniques in the financial field, the opportunities open to address the future AI-powered financial field and financially motivated AI research.

Manju Kunwar's 2019 study titled:

Artificial Intelligence in Finance: Understanding how automation and machine learning is transforming the financial industry.

This study aimed to examine the impact of artificial intelligence on the modern world, particularly in the field of finance. It discussed the general concept of artificial intelligence in the present, past, and future, focusing on the application of artificial intelligence, its benefits, challenges, opportunities, and impact on jobs. The application and impact of artificial intelligence in finance were also explored while examining how artificial intelligence is changing the financial services industry.

Study Structure:

To address the various aspects of the problem, we divided this research into three sections. In the first, we addressed the concept of artificial intelligence and some related terms, examining its development. In the second section, we reviewed the applications of artificial intelligence in the financial sector. In the third section, we addressed the challenges of artificial intelligence in the financial field and ways to address them.

2. The Concept of Artificial Intelligence

The term "artificial intelligence" has become popular and has made significant progress in its technologies. Its capabilities have greatly increased in today's world, spurring the design of a variety of practical applications in the financial sector, as well as other areas of expertise. In this section, we will discuss the concept of artificial intelligence and its historical development.

2.1. Definition of Artificial Intelligence:

Artificial intelligence has several definitions, which we present as follows: It is defined as "a new technological science that integrates theory, method, technology, and application systems through computer simulation, making it similar to human thinking and expanding the scope of human intelligence. Its essence is to become a complete and mature intelligent machine by continuously simulating and exploring human behavior" (Yuxin Li, et al., 2021, p. 97). It is also defined as "a general mental capacity for thinking, problem-solving, and learning." It is also defined as an intelligent system created to use and analyze data and perform specific tasks without the need for programming. AI has a powerful ability to create a basis for decision-making and support through insights and results, gathered from massive and complex data sets, compressed into a manageable scope (Mhlanga, 2020, p. 4). It can be defined as the ability of a machine to imitate human intelligence or exceed the ability of human intelligence. It is an algorithm (specific software) that runs on a computer or a group of computers. It is not an electrical device that replaces the human brain. Artificial intelligence also refers to the machine simulation of the human brain's workings, relying on massive amounts of data. This leads many to believe that it will not replace human intelligence in the near future. However, its use is increasing in diverse fields, from business to politics. There are some overlapping and similar terms for artificial intelligence, which we will explain below:

Machine learning: It is a part of artificial intelligence. It is a technology for analyzing data, learning from that data, and then applying what they have learned to make informed decisions. Machine learning constitutes the ability of machines to learn from analyzing data (Lahmar, 2021, p. 96). Traditional machine learning techniques were limited to processing raw data in its raw form, and machine learning systems were

considered part of artificial intelligence systems only in the early years. However, now machine learning has become more independent. Machine learning refers to a broad discipline that focuses on the automated use of data and algorithms without explicit programming. Humans learn to perform a task through experience and practice. While machine learning algorithms know how to complete a task through additional data and multiple models (Ajitha, et al., 2023, p. 02), and although machine learning algorithms can handle many problems, they cannot solve complex and complicated problems. Some actions that humans do easily, such as facial, voice, or handwriting recognition, are extremely difficult for machines (Lahmar, 2021, p. 96).

Deep learning: It is a subset of machine learning that improves the current structural framework of machine learning. It includes representation learning that discovers and designs various patterns and trends necessary for detection or classification from unstructured data sets. It is based on an artificial neural network, where algorithms are organized into multiple processing layers, which helps in learning complex tasks. These networks replicate human intelligence in their operations, thus eliminating further manual human intervention. (Ajitha, et al., 2023, p. 02)

2.2. The development of artificial intelligence:

The roots of artificial intelligence go back to a summer research project proposal at Dartmouth in 1955, which was designed to enable machines to simulate the human mind (Ajitha et al., 2023, p. 2). The introduction of artificial intelligence was a long-standing automated process. Advances in information technology in the mid- and late 20th century led to the automation of standardized data processing. After years of development, AI theory and technology have become more mature than ever, (Yuxin Li, et la., 2021, p. 97) so that AI research went through many ups and downs until it rose again in 2012, driven by today's deep learning revolution, and in January 2016 at the Davos Forum, where AI and big data were considered the essence of the Fourth Industrial Revolution, it has now penetrated the simple simulation of human behavior and evolved into a complex, multi-functional, application-oriented system (Yuxin Li et al., 2021, p. 97), thus handling complex tasks. Artificial intelligence represents the evolution of the computer from being a mere tool that simulates human intelligence to achieving intellectual processes and self-learning. Machine learning and deep learning technologies, included in artificial intelligence, have grown. To become the most promising branch of the modern technological revolution (Ajitha, et al., 2023, p. 02) This technology is known as virtual reality technology and 3D printing technology, as “the most acute technology of the early 21st century, (Yuxin Li, et la., 2021, p. 97) as it took a few decades for people to realize the true power of artificial intelligence, prominent investors and physicists, such as Elon Musk, founder of Tesla, and Stephen Hawking, continue to discuss the innovative potential of artificial intelligence. They agree that when used for good, AI could radically change the course of human history (Kunwar, 2019, p. 9).

3. Artificial Intelligence Applications in the Financial Sector:

With the increasing spread of the use of artificial intelligence in all fields and industries, it has become a practical approach and a powerful tool that has the potential to transform the entire financial sector (Halder, 2022, p. 01). In this section, we will discuss its applications in asset management, algorithmic trading, and consulting. We will also

discuss its applications in smart contracts and its relationship with blockchain records. We will highlight its role in improving credit underwriting processes, detecting fraud, providing security, and predicting financial risks.

3.1. Artificial intelligence applications in asset management:

Artificial intelligence (AI) technologies are being applied in asset management and market buying activity by financial institutions and managers, given the ability of AI and machine learning models to identify signals and capture underlying relationships in big data (OECD, 2021, p. 8) (adapted). These models are obtained from various markets, and help clients manage investment portfolios in terms of tax efficiency, rebalancing, risk, and return (Farahani, 2022, p. 42) (adapted).

It should be noted that the use of artificial intelligence and machine learning in asset management offers several advantages, which we list as follows:

- Increasing the efficiency and accuracy of operational workflow, enhancing performance and risk management, as well as improving customer experience (Belhaj, Hachaïchi, 2023, p. 02) and helping them achieve profit in the market by automating portfolio management services (adapted) (Farahani, 2022, p. 42).
- Reducing back-office costs for investment managers and replacing intensive manual settlements with automated settlements enables reducing costs and increasing speed (Belhaj, Hachaïchi, 2023, p. 02).
- Portfolio optimization involves finding a set of investment assets that meet a particular investor's needs while maximizing a specific objective. Advanced models allow investors to incorporate their expectations and confidence levels, while big data enables the integration of market sentiment or other macroeconomic factors such as GDP growth or inflation (Weber et al., 2023, p. 11).
- Provide users with information reference for investment decision making.
- Intelligent robo-advisors outperform humans in investment allocation, and their ability to execute transactions also enables them to help investors overcome their emotional weaknesses, an area in which financial institutions are applying AI technology on a larger scale at the present time (Yuxin Li, et al., 2021, p. 105) (adapted).

It should be noted that there are many AI-based portfolio management tools, but they require thinking about easy ways to prevent financial data leakage at a low cost, as well as using natural language generation technology, which allows advice to be provided to clients in simplified language that they understand. This is what financial advisors recommend to add a human touch to the data analysis prepared by automated advisors. Accordingly, there is a need to define new algorithms and implement an AI-based platform that analyzes each investor's portfolio and suggests the best financial plan when investing in cryptocurrencies, mutual funds, dividend stock funds, or other financial fields (Halder, 2022, p. 03) (Belhaj, Hachaïchi, 2023, p. 02) (adapted).

This was embodied in the United States, where AI investment banking services emerged in 2008. The growing demand for wealth management in the market has also led Wall Street to become enthusiastic about applying AI and big data in asset management. Currently, there are several mature smart investment platforms in the US market,

including Fund Vanguard, Schwab Charles, Betterment, and Wealthfront (Yuxin Li et al., 2021, p. 105) (adapted).

3.2. Algorithmic trading and its connection to artificial intelligence:

Algorithmic trading, also known as automated trading systems, has become a dominant force in financial markets worldwide. Algorithmic trading involves the use of complex artificial intelligence systems to generate trading options at rates exceeding what any human could, often generating millions of trades in a single day without human intervention. This type is known as high-frequency trading and is one of the fastest growing areas of financial trading (Kunwar, 2019, p. 26). It should be noted that there are three reasons for using artificial intelligence in algorithmic trading, which we list as follows: (Farahani, 2022, p. 43).

- Put and analyze massive amounts of data without any human intervention
- Machine learning creates a situation where computers can perform financial analysis faster and more accurately than humans.
- Real-time trading, high-speed transaction processing, and handling complex data structures are all capabilities that AI and machine learning can handle efficiently. Furthermore, stock market trading benefits from the use of AI, which is expected to hinder emotional investment decisions due to its irrationality (Weber et al., 2023, p. 10).

Another important benefit of algorithmic trading is that it automates trading and executes it under conditions that are considered ideal for buying or selling—because orders are placed instantly—thus ensuring investors don't miss out on significant opportunities. This trading also reduces transaction costs (Kunwar, 2019, p. 27) and the likelihood of errors, enabling the most complex and difficult problems to be resolved quickly and with minimal error. It also enables saving time and high and uninterrupted speed in collecting and solving information (Farahani, 2022, p. 43).

3.3. Artificial intelligence applications, chatbots, and virtual assistants (Chatbots):

Artificial intelligence is impacting wealth management through robo-advisors that provide automated financial planning services such as tax planning advice, insurance advice, health and investment advice, and many other vital services (Mhlanga, 2020, p. 10). It's worth noting that large fintech institutions have a large customer base, requiring automated customer service alternatives such as chatbots. These robots offer 24-hour service, making the institution's operations safer and more efficient in meeting ever-changing customer demands.

Banks have been using smart AI alternatives to provide the best possible user experience and improve accessibility. Chatbots have also been used by businesses for customer service purposes as virtual assistants. Conversational bots are an AI technology used in the peer-to-peer (P2P) sector. For example, Lemonade uses machine learning and chatbots. Providing property and casualty insurance services to homeowners and renters, where insurance takes about 90 seconds and payment takes three minutes (Kunwar, 2019, pp. 27-28).

3.4. Artificial intelligence applications and blockchain:

Blockchain is known as a chain of blocks or chained records, and it is a distributed database of records or what is called a public ledger of all digital transactions or events that have been executed and shared between participating parties (Crosby et al, 2016, p 08). Where each record holds the same data and is maintained and controlled collectively by a distributed network of computer servers called nodes, blockchain uses a set of specific mathematical algorithms to create and verify an ever-increasing data structure. It should be noted that the data in the blockchain cannot be removed (R. HOUBEN and A. SNYERS, 2018, p. 15), because all blocks are connected via hash functions, so that any tampering that occurs in one of the blocks leads to the invalidation of all the following blocks (Renduchintala and al, 2022, p. 4). Artificial intelligence for prediction and automation can be incorporated into smart contracts, which are defined as “computerized transaction protocols that enforce the terms of a contract.” The basic idea of smart contracts is that many types of contractual clauses, such as privileges, conditions, ownership rights, and others, can be embedded into software that is handled in a way that makes breach of the contract very costly. It is worth noting that digital contracts are executed for synthetic assets such as derivatives and bonds, and smart contracts are stored using blockchain technology to provide security for these contracts (Lian, 2019, pp. 49-50, adapted), by providing this technology with trust, privacy, and accountability for artificial intelligence (Halder, 2022, p. 1).

3.5. The role of artificial intelligence applications in improving credit underwriting processes:

Artificial intelligence has an influential role in credit decisions, as its solutions help both financial institutions and credit providers make smarter underwriting decisions by using multiple factors and variables - that accurately assess traditionally underserved borrowers - in the credit decision-making process, to make it a sound and data-supported decision (Mhlanga, 2020, p. 09), (Kunwar, 2019, p. 26) (adapted).

With the increasing use of AI-based models and big data by banks and fintech lenders, the creditworthiness of potential borrowers is being assessed more quickly, more accurately, and at lower costs (Belhaj, Hachaïchi, 2023, p. 3). It should be noted that credit scoring using AI is based on more complex and advanced rules that differ from traditional loan scoring schemes. This enables lenders to distinguish between candidates at risk of default and those who are creditworthy but lack a credit rating. To verify loan eligibility and provide personalized options, digital banks and loan origination apps use machine learning algorithms to analyze credit status with optional information such as smartphone data (Kunwar, 2019, p. 26).

3.6. Artificial intelligence to detect fraud, examine and monitor transactions:

Artificial intelligence and big data are being used by financial institutions and fintech lenders to detect fraud and suspicious activity during continuous customer monitoring. These institutions can help identify abnormal transactions, suspicious activity, potential fraudulent use of customer personal information, misrepresentation of products or services, and other fraudulent activities, and this by using image recognition software, risk models, and other AI-based technologies (OECD, 2021, p. 29).

3.7. The role of artificial intelligence in providing security:

Artificial intelligence plays a significant role in improving the security of online finance. With the massive volume of digital transactions taking place across online accounts every day, and sometimes even via mobile phones and apps, intensifying cybersecurity and fraud detection efforts has become a necessity for any financial institution or bank to protect against and prevent potential security breaches.

In this context, many exchanges use machine learning to identify market patterns, improve monitoring, and prevent manipulation of high-frequency trading (HFT) markets (Mhlanga, 2020, p. 10).

3.8. Applications of artificial intelligence in predicting financial risks:

Financial institutions continually identify and measure financial risks by predicting, for example, defaults, bankruptcies, and fraud detection, in order to control these risks. Predicting debtors' defaults and bankruptcies indicates a state of (institutional) failure. Therefore, default prediction is concerned with estimating the probability of financial institution debtors and credit card holders falling into default using available information in the form of personal files, loan history and repayment history. Bankruptcy prediction also deals with publicly available information and extracts accounting ratios to determine the probability of a company's bankruptcy, which is valuable information for potential investors and existing creditors.

Accordingly, artificial intelligence methods support the process of predicting default and bankruptcy by incorporating massive amounts of available data and evaluating multiple cases. In the case of public companies, artificial intelligence models can suggest potential actions, such as approving or rejecting credit card or loan applications. It is more accurate in the case of hypothetical forecasting. For example, a gradient tree-boosted model can be used to classify SME loans into non-performing and non-performing loans, with the possibility of including nearly 50 different forecasting variables, including the variable number of days late until payment (late days) to predict rare events such as default on loans (Weber, et al., 2023, p. 10).

4. Challenges of artificial intelligence in the financial sector and ways to address them:

In this section, we will address the challenges of artificial intelligence in the financial sector and discuss ways to address them.

4.1. Challenges of Artificial Intelligence in the Financial Sector:

Although artificial intelligence yields impressive results, including the ability to provide predictions, recommendations, or decisions using massive amounts of alternative data sources and their analysis, referred to as big data, in several financial fields such as risk management, algorithmic trading, credit underwriting, and blockchain-based financial services, and other applications that we have touched upon, but there are still some existing challenges that need appropriate treatment (Belhaj, Hachaïchi, 2023, p. 02) (Halder, 2022, p. 2) (adapted) We present them as follows:

- **Data Privacy and Biased Decision Making:** Since there will not be an accurate, integrated AI at the outset, this will present various challenges, including its reliance on historical data when making decisions, which is inaccurate (Halder, 2022, p. 02). AI

models can also be biased if trained on unrepresentative or unbiased data, which can lead to poor decision-making (Božić, 2023, p. 09).

- **Data quality and accountability requirements for deploying AI technology:** The predictive power of an algorithm depends heavily on the quality of the data provided as input, so the limited availability of adequate quality and quantity of data can be a barrier to the power of AI. Furthermore, the use of intelligent machines poses a challenge regarding accountability, raising the question of why and who will be held responsible if something goes wrong?. Therefore, financial institutions are sometimes reluctant to grant machines complete autonomy because the machines' behavior is not entirely predictable, and in many cases they tend to keep a human supervisor in place to validate important machine activities and decisions such as blocking or releasing payments (Mhlana, 2020, p 10).
- **Limited transparency:** AI models can be complex, making it difficult to understand how they arrive at their conclusions. This lack of transparency can make it difficult for risk managers to trust and interpret AI outputs.
- **Technical expertise:** Using AI requires a high level of technical expertise, and organizations may not have the resources or expertise to implement and maintain AI models.

Security risks: Storing and processing large amounts of sensitive data required for AI models can pose security risks, such as data breaches or cyber attacks.

- **Legal and Ethical Issues:** The use of AI can raise legal and ethical issues related to data privacy, transparency, and accountability (Božić, 2023, p. 09).
- **Ways to address the challenges of artificial intelligence:** Now that we have identified the challenges of artificial intelligence, we will discuss some ways to overcome the challenges of using artificial intelligence in risk management.
- **Increased transparency:** To overcome the limited transparency of AI models, organizations can use techniques such as Explainable Artificial Intelligence (XAI) or visualization techniques to help risk managers understand how models reach their conclusions.
- **Addressing biases:** To overcome biases in AI models, organizations can ensure that the data used to train models is diverse, unbiased, and representative. They can also use techniques such as removing bias that may be present in the data.
- **Building technical expertise:** Organizations can overcome a lack of technical expertise by investing in training programs or partnering with AI experts who can provide support and guidance.
- **Enhance security:** Organizations can implement robust security measures to address security risks such as encryption, multi-factor authentication, and regular security audits.
- **Addressing legal and ethical issues:** Organizations can ensure compliance with legal and ethical requirements by developing and adhering to clear policies and guidelines for the use of AI, as well as ensuring transparency and accountability in their AI models. Organizations must also take a comprehensive approach to AI risk management by addressing and mitigating the associated technical, ethical, legal, and security risks and challenges, to be able to maximize the benefits of artificial intelligence (Božić, 2023, p. 09).

5. Conclusion:

Through our study of the role of artificial intelligence in improving the financial sector, we reached the following conclusions:

- Artificial intelligence and machine learning play a significant role in the financial services industry in gaining competitive intelligence. They have transformed the financial industry landscape by automating decision-making and improving internal banking operations, helping financial institutions and credit providers make smarter underwriting decisions. It assesses the creditworthiness of potential borrowers more quickly, accurately, and at lower costs. It plays a significant role in improving the security of online financing and contributes to the process of predicting defaults and bankruptcy.
- Its use in asset management offers several advantages, including helping clients manage investment portfolios in terms of tax efficiency, rebalancing, risk, and return, quickly and at lower costs, while incorporating many factors, including macroeconomic variables and market sentiment.
- Algorithmic trading involves the use of complex artificial intelligence systems to generate trading options at rates exceeding what any human could do and with high accuracy, while neutralizing emotional investment decisions due to their irrationality.
- Banks have been using smart AI alternatives to provide the best possible user experience and improve accessibility, and chatbots have been used by fintechs and businesses for their customer service purposes as virtual assistants.
- Artificial intelligence and big data are being used by financial institutions and fintech lenders to detect fraud and suspicious activity while continuously monitoring customers.

Therefore, although artificial intelligence and machine learning are producing impressive results that have revolutionized the financial sector, as confirmed by the three previous studies, there are still some existing challenges, represented by data privacy and quality, biased decision-making, limited transparency, security risks, and legal and ethical issues. To overcome these challenges, we recommend using technologies that increase transparency, building technical expertise, implementing robust security measures to enhance safety, and addressing biases and legal and ethical issues.

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