

Accelerating Business Growth with Big Data and Artificial Intelligence

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Abstract

Artificial Intelligence is the simulation of human or animal intelligence in computational systems aiming to think like intelligent beings and mimic the actions of intelligent entities. AI plays a major role against business world's problems, especially Machine learning and Deep learning (subset of AI). The paper discusses some AI and big data technologies that are currently being used to accelerate business growth.

I. Introduction

A business can be defined as “an enterprising entity or an organization consisting of people and assets, that is involved in professional, commercial or industrial activities to make a monetary profit”. All types of businesses have been affected by modern technology and many of them have started using modern cutting-edge such as Artificial Intelligence, Data Science, Big Data, Internet Of Things (IoT) to accelerate growth and boost profits significantly. AI's applications demonstrating its ability to outperform or match human capabilities, estimations indicate that computational technologies could take over 47% of the current jobs in the world within the next decades. However, as technology substantially impact the economic landscape and the understanding of cutting-edge technologies on the business world is deemed essential.

A study analyzing 100 AI startups reveals a staggering increase in investments, from \$25.88 million in 2011 to \$1866.6 million in 2016, demonstrating the significant influence of artificial intelligence and big data on the current business landscape.

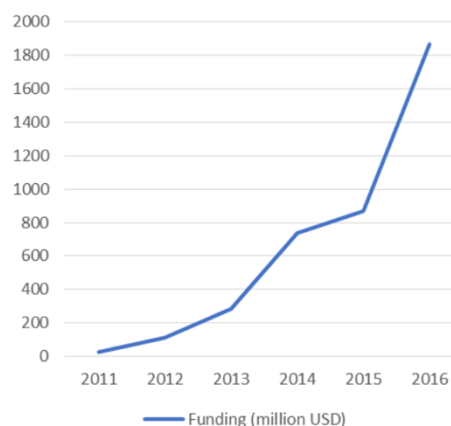


Fig.1. Bar graph of the total investment every year of the 100 AI startups as analysed by Soni et al. [4]

Many companies like Cognizant develop artificially intelligent systems to improve business processes and revenue. Cognizant's solution saved \$30 million in capital through improved equipment utilization

and higher availability. This underscores how AI and data analysis are actively used in modern industries to cut costs, optimize profits, and drive business growth.

II. Related Works

Some major areas where AI and big data solutions play a crucial role in finance and business are discussed below:

A. Fraud Detection

Fraud is a significant challenge in the economic world, which cause substantial losses for businesses. The total fraud losses reached \$27.85 billion in 2018 and are estimated to rise to \$40.63 billion in the coming decade. Therefore, computational systems capable of detecting and preventing fraudulent activities would rapidly accelerate business and economic growth.

Fraud detection techniques are generally classified into two categories: anomaly detection and misuse detection.

- Anomaly detection: learns customer transaction behavior and classified them according to customer historic.
- Misuse detection uses a general fraudulent pattern to classified activities.

Awoyemi et al. compared traditional machine learning models for credit card fraud detection, including the naive Bayes classifier, logistic regression classifier, and k-nearest neighbor classifier. Their findings showed varying accuracies, with the naive Bayes classifier achieving 97.92%, logistic regression achieving 54.86%, and k-nearest neighbor achieving 97.69%.

Xuan et al. introduced a random forest algorithm for credit card fraud detection, using a dataset from a Chinese e-commerce company. Using two random forest models employing different base classifiers, they achieved accuracies of 91.96% and 96.77%.

Randhawa et al. compared the performance of 12 machine learning algorithms on credit card fraud detection, using a public credit card transaction dataset. They experimented with ensemble methods, and the best accuracy (99.941%) was achieved by an ensemble of Neural Network and Naive Bayes classifier.

B. Algorithmic Trading

The trading process generally consists of 4 components, pre-trade analysis, trading signal generation, trade execution and post-trade analysis. Algorithmic trading can be defined as the automation of these steps or all of them. AI has completely transformed this area by the automation of the trading processes, creating profit without any human intervention, which impact consequently business and growth.

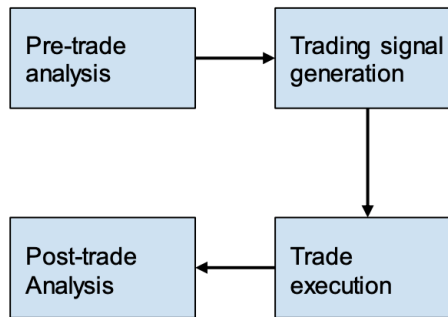


Fig. 2. Steps in a complete algorithmic trading system

Roondiwal et al. propose a learning algorithm for predicting stock prices, employing Long Short Term Memory (LSTM), a type of recurrent neural network known for its memory cells that capture data structures. Through experiments with different parameters, the best-performing LSTM achieved an exceptionally low Root Mean Square Error (RMSE) of 0.00859, demonstrating the effective use of artificial intelligence in stock price prediction.

Colianni et al. utilize sentiment analysis to predict Bitcoin prices. They collect tweets containing the keyword "bitcoin" using an open-source API and extract features from the tweets. Their algorithm doesn't predict specific percentage changes, however, showcases an interesting application of AI.

C. Customer Service

AI and data science solutions have also been used to customer service through chatbot. The implementation of AI eliminates the need for dedicated personnel to address customer queries. This approach has proven widely successful across various industries, reducing hiring costs and contributing to business growth.

Cui et al. introduced a chatbot named "superagent," designed to function as a customer service provider for e-commerce websites like Amazon. The system comprises three engines: FACT QA for product information, FAQ search for customer queries, and Opinion-Oriented Text QA for reviews. Such systems have the potential to save companies millions of dollars by efficiently managing customer interactions.

D. Marketing and Product Recommendation

AI and big data have significantly impacted marketing with data-driven strategies proving more effective than traditional human-based approaches. Social media platforms leverage AI and machine learning to display personalized advertisements.

Sundsoy et al. conducted an experiment comparing big data-driven marketing strategies to traditional methods in an Asian mobile network operator. The results indicated a 13 times higher conversion rate in the treatment group (selected using data-driven models) than the control group (chosen by marketing officials). This experiment clearly shows the power of data-driven analytics and how it can impact and accelerate business growth.

Padarami et al. propose a hybrid recommender system for recommending business products. Consisting of a deep artificial neural network incorporating reviews, content-based features, and collaborative features for accurate product recommendations. The approach reduces digital memory footprint, enabling real-time recommendation systems with instant responsiveness.

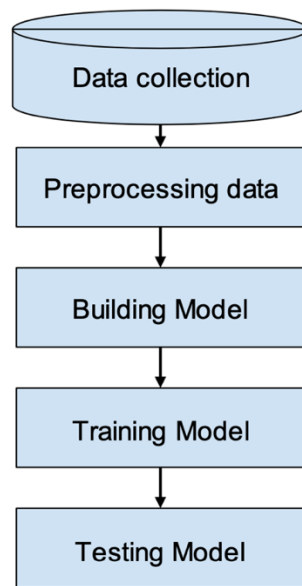


Fig. 3. General scheme of an AI model

E. Cyber Security

Cybercrime poses a significant threat to modern businesses, with an estimated loss of \$6 trillion in 2021. To combat this, effective cybersecurity technologies are crucial for business growth and sustainability. AI and machine learning play a vital role in addressing cybercrimes, particularly in three main categories: intrusion detection, malware analysis, and phishing detection.

Kim et al. utilized Long Short-Term Memory (LSTM), a type of Recurrent Neural Network, for intrusion detection in cybersecurity systems. Their experiments, conducted on the KDD Cup 1999 dataset with 4,898,431 network traffics, demonstrated LSTM-RNN achieving the highest accuracy at 96.93%.

Gupta et al. introduced an artificial neural network with Particle Swarm Optimization (PSO) for detecting phishing URLs. In their study, they compared the performance of a backpropagation neural network with a PSO neural network on their dataset. The PSO neural network achieved an accuracy of 93.93% with 67 hidden neurons and the tansig activation function.

Machine learning is heavily influencing the field of cybersecurity and many companies are using it to fight cybercrimes and save billions of dollars.

TABLE I. PAST WORK IS DONE IN THE FIELD OF BUSINESS ANALYTICS

Name of Author	Year of Publication	Methods used	Dataset used	Use case
Paradarami et al. [18]	2017	Deep ANN + content-based features + collaborative features	Yelp academic dataset	Product Recommendation
Awoyemi et al. [8]	2017	K-nearest neighbour/ naive bayes/ logistic regression	Credit card transaction of european cardholders dataset	Fraud detection
Xuan et al. [7]	2018	Random forest	Credit card transaction dataset of chinese e-commerce company	Fraud detection
Randhawa et al. [10]	2018	Adaboost + majority voting , ANN + NB	Public credit card transaction dataset	Fraud detection
Roondiwala et al. [12]	2017	LSTM	New York stock exchange dataset	Stock prices prediction using time series data
Colianni et al. [13]	2015	NLP + SVM/NB	Twitter data	Bitcoin price prediction using sentiment analysis
Cui et al. [15]	2018	NLP + Deep ANN	E-commerce data	Customer service
Kim et al. [21]	2016	LSTM	KDD cup 1999 dataset	Intrusion detection in cyber security
Gupta et al. [22]	2017	ANN with PSO	UCI repository archive	Phishing detection in cyber security

III. Further Applications and Decisions

Table I shows recent works in artificial intelligence and data science over the past five years, highlighting diverse applications across business and finance. The scope of AI in business analytics is vast, enhancing efficiency and productivity throughout the entire value chain, from developing business models to delivering products to customers.

AI extends beyond finance and business, impacting areas such as automatic retail transactions in supermarkets, exemplified by Amazon Go stores. Credit scoring is another domain where AI and ML algorithms excel, assigning credit scores based on customer data.

Portfolio management benefits from AI solutions like deterministic deep reinforcement learning for cryptocurrency investments and recurrent artificial neural networks for dynamic portfolio optimizations.

Harvard Business Review categorizes AI applications into three types dominating the business industry: process automation (47%), cognitive insights (38%), and cognitive engagement (16%). Process automation involves tasks like reading legal documents and extracting relevant information using NLP techniques. Cognitive insights address issues like predicting customer preferences and analyzing warranty data. Cognitive engagement includes recommendation systems for personalized health treatment plans. These findings showcase the broad and transformative impact of AI on diverse business sectors.

III. Conclusion and Future Works

In the paper, several applications of machine learning, deep learning and data science in the context of business and their growth have been reviewed. AI has utterly transformed the business world, and many people are working with artificial intelligence systems to solve complex problems in the world.

AI has been used successfully to drive the modern economic world and it will be a key player in shaping the future. The AI of tomorrow will undoubtedly change the business and might do every job from building a business model to supplying it into the market, rendering human intervention obsolete.