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A value-oriented Artificial Intelligence-as-a-Service business plan using integrated tools and services

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ABSTRACT

The latest developments in Artificial Intelligence (AI) are the focal point in increasing the performance of other technologies and the evolution of Industry 4.0. Considering the benefits of AI in today's world, businesses must move towards using Integrated AI tools and services. This paper introduces a business model based on AI-as-a-Service (AIaaS), which provides an integrated bundle of AI products and services. The strategic approach, roadmap, and heuristic pricing model provided in this paper can be considered as a benchmark for AIaaS companies.

1. Introduction

The growth of artificial intelligence (AI) as a scientific field and a technological capability has not been observed in many other fields during the last 50 years. The main reason behind this significant growth should be associated with the human need and desire to automate, optimize and increase the accuracy of activities that are generally performed by human labor. Therefore, the main problem of artificial intelligence is to build a machine that can think and behave like a human in performing one or more specific activities and thus achieve a degree of intelligence [1]. An intelligent machine can solve a problem with a specific purpose in mind using data received from its environment and its learning power built by an algorithm [2]. According to [3] the capabilities of artificial intelligence systems can be addressed by considering two important dimensions: reasoning–behavior dimension and human performance–rationality dimension. Accordingly, there are four types of artificial intelligence systems: (1) Systems that think like humans, (2) Systems that act like humans, (3) Systems that think rationally, (4) Systems that act rationally. Each of these types of intelligent systems can appear in different business applications and meet different industrial and commercial needs.

The capabilities and opportunities of artificial intelligence have received much attention in the digital age and this branch of technology is considered as one of the main axes of digital evolution. It can be said that the advances made in artificial intelligence are the focal point in increasing the performance of other technologies and the evolution of the Industry 4.0 [4]. Various research works have shown that artificial intelligence technology provides new opportunities which can cause significant changes in business and greatly affect their economy [5–9]. Different fields such as manufacturing and construction, energy and utilities, sales, marketing, supply chain management, finance, education, health and entertainment use the tremendous capabilities of artificial intelligence to increase efficiency, automate processes, reduce labor costs and thus increase their return on investment (ROI). As shown in a study by Murugesan et al. [10], AI can even have an impact on human resources digitization in the Industry 4.0. On the other hand, the speedy growth of the Internet and cloud computing technologies has led to a dramatic change in various forms of business creating e-business, e-commerce, e-health, e-learning and similar forms. Therefore, essential elements and requirements such as e-signature, e-order, e-payment, mobile banking has been emerged to advance the goals and improve the performance of these areas [9,11]. Also, due to the speed of generation and dissemination of data and information, business environments must use big data technologies to be able to process and extract knowledge contained in them to improve the efficiency and effectiveness of the business [12]. Predictive data analytics has become more prevalent, especially in financial sectors, banking processes and security fields. Artificial intelligence methods, especially machine learning and deep learning play a very crucial role in discovering hidden patterns in data and creating predictive capability from them [13,14]. The use of robots, especially in the aerospace, manufacturing, automotive, health, and process automation for different domains, has grown significantly and more businesses have begun to use robotic capabilities in their operations. Recently the explainable AI has shifted the area to even become more effective and transparent by providing

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explanations on AI or machine learning methods' interior design and how they come into a decision or predictions for human users [15].

Considering the benefits of artificial intelligence in today's world and the rapid growth of its functions, it seems necessary for any type of business to move towards the use of artificial intelligence tools to improve performance and quality, increase ROI, and reduce costs. In fact, artificial intelligence has grown so much that its impact is visible on all aspects of businesses, and avoiding its use leads to being left behind competitors and losing a lot of profits. As a result, the number of enterprises using AI in business grew by 270% between 2015 and 2019, according to Gartner [16]. Based on the implications of the recent surge in AI technologies and its opportunities and challenges in association with digital transformation, Holmström [17] introduced an AI readiness assessment framework by considering four key dimensions: technologies, activities, boundaries, and goals.

Findings from McKinsey's 2021 survey indicate that AI adoption is continuing its steady growth: 56 percent of all respondents reported AI adoption in at least one function, up from 50 percent in 2020. The newest results suggest that AI adoption since last year has increased most at companies headquartered in emerging economies, including China, the Middle East and North Africa [18]. According to McKinsey's survey, AI adoption in the COVID-19 pandemic's first year brought up to more than 20 percent reduction in business functions while revenue increases were above 10 percent. It is clear the successful companies' investments in AI will continue to increase over the next three years and more companies need to focus on integrating their business model with AI. While the global AI's market size was valued at USD 328.34 billion in 2021, the market is projected to grow from USD 387.45 billion in 2022 to USD 1,394.30 billion by 2029, exhibiting a CAGR of 20.1% during the forecast period [19].

To take advantage of such a promising space created by artificial intelligence, companies can act in two ways:

- Adopt and incorporate AI in business-related processes, operations, and services,
- Use AI as the key component of their business model and provide AI products and services to other businesses.

The first case is something that can be seen in most companies today and was mentioned in the statistics above. But the bottom line is that for a company to enjoy the benefits of artificial intelligence, it must receive artificial intelligence products and services from another company which specializes in AI modern technologies. There are few companies which can create AI applications with their development units. Therefore, according to the second case, there should be companies that can provide artificial intelligence services and products in accordance with the needs of businesses. In fact, in this case, the provision of artificial intelligence products and services can be included in a business model and the main profit of the provider company is created in this way [20,21].

Such a business model is called Artificial Intelligence as a Service (AIaaS). AIaaS is a new method that, like cloud services, provides artificial intelligence services and solutions according to the needs of companies and with subscription payment models or payment on demand [22]. Often these services are provided in the form of APIs and companies can receive any AI services such as machine learning models, natural language processing, image processing, etc. whenever the need. The advantages of this type of service for user companies are: (I) No need for specialized skills of artificial intelligence; (II) Tested and high-speed infrastructure; (III) Transparent payment models in terms of use; (IV) Usability; and (V) Scalability.

This paper presents a case study to introduce a business model and plan based on the second case. The business plan is defined according to AIaaS model by providing an integrated package of artificial intelligence products and services to companies and organizations in need. Products and services in this package are defined using modern technologies and based on customer needs with the ability to be customized and adjusted according to other commercial needs as well. It is noteworthy that numerous studies have formerly scrutinized the commercialization and business modeling process of research-based products. Accordingly, Bazan [23] developed a notable framework to associate science and engineering research with commercial outcomes in terms of a seamless transition from research to business. From a more holistic viewpoint Si and Chen [24] performed a literature review of disruptive innovation. They developed a multilevel theoretical framework to examine its firm-level influence factors and aspects, particularly in the commercialization process. Schmidt and Scaringella [25] explored the disruptors' business model innovation activities to evidence the relationships between dynamic capabilities and value proposition innovation.

The business model here is outlined in terms of a case study in one of the leading Asian companies in the field of information technology.[1] The company's software products and services are designed and ready to be used in order to take advantage of the capabilities of new technologies to improve the business environment. In designing these tools, the most up-to-date machine learning algorithms and artificial intelligence have been used, and the design of the services has been done is such a way that they have the required flexibility to be adopted in monitoring, management, functional and customer relationship management systems. The commercialization package of AIaaS, has its contribution anchored in the integrated promotion of AI products and applications for exterior enterprises in terms of open innovation ecosystem. The strategic approach and systematic roadmap provided here can be considered as a potent tool and experience to pave the way for similar projects within the field of information and communication technology. Hence, the enterprises providing AIaaS are potentially considered as the specific audiences of this study. Our case study focuses on three important elements of the company's AIaaS business plan: Business roadmap to achieve main objectives, AIaaS package specifications, and the commercialization action plan and linchpin.

The rest of paper is structured as follows: In the next section, related work on AIaaS is presented for the reader to better introduce this emerging field. In Section 3, the business model that is formed based on the package of AI services is described. Then the roadmap, strategy and the requirement behind this model is presented. In Section 4, the structure of the AI package, the included services and their relationships are described. Then a brief description of the features of the services and products in the three categories of machine vision, natural language processing, and data-driven systems is provided. We also present a summary of the applications of each individual service in the business domains. In Section 5, we describe the commercialization approach and the measures taken to facilitate the journey of the services to the market with standard methodologies. In Section 6, we conclude the paper with some suggestions on future works.

2. Related work

Artificial Intelligence-as-a-Service (AIaaS) has emerged as a transformative business model that leverages the power of artificial intelligence (AI) technologies to provide scalable and accessible AI solutions to various industries. In this section, we present some of the most recent advancements and trends in the field of AIaaS, highlighting its potential benefits, challenges, and implications. The following studies shed light on the current state of AIaaS and how it can be adopted in different domains.

AIaaS refers to the provision of AI capabilities and resources as on-demand services through the cloud, enabling organizations to leverage AI technologies without the need for significant upfront investments in infrastructure and expertise Huang and Rust [26]. In order to deepen the understanding of AIaaS, Lins et al. [27] published

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a catchword article to define AIaaS stack and its hierarchical software/developer/infrastructure layers, discuss its core characteristics, and elaborate on its open socio-technical challenges and future research directions. Lewicki et al. [28] provided a systematic review of the AIaaS space by proposing a taxonomy of AI services based on the levels of autonomy afforded to the user. They examined the different categories of AIaaS, outlining how these services can lead to biases or be otherwise harmful in the context of end-user applications.

The importance of deploying on-premise AIaaS Service for small and medium size companies was studied by Fortuna et al. [29]. The authors investigated the AIaaS functionality and corresponding technology stack and analyzed possible realizations using open-source user friendly technologies that are suitable for on-premise setups allowing full control over their data, processes and costs, where this is needed, without any third-party dependence or vendor lock-in. Since some of the major concerns in migrating to AIaaS models are privacy, security and compression of the data, Guntupalli and Rudramalla [30] proposed an optimized algorithm for providing Data Compression, Data Integrity and Data Confidentiality of the AIaaS deployments. AIaaS platforms usually have an online repository containing a bunch of ML services and tools where users can access and choose what satisfy their needs. The challenge is that selecting the optimal ML model or AI service is now always an easy task. In order to tackle this challenge, a dynamic approach was proposed by [31] for selecting the most appropriate ML model using Deep Reinforcement Learning (DRL). The authors demonstrated the effectiveness of their method in a specific use case of energy consumption forecasting.

In order to highlight the importance of AIaaS in today's world, one must examine the emerging applications of this new business model. Various applications in different industries and businesses can be imagined for this model. One promising domain is autonomous driving. De Caro et al. [32] designed and developed an AI-as-a-Service toolkit for an autonomous driving personalization system according to the output of an automatic driver's stress recognition algorithm in the context of a cyber physical system. They implemented a data-gathering subsystem to collect data from different sensors such as wearables and cameras, to automatize stress recognition. They also used different learning algorithm to provide proper functionality in the subsystems. AIaaS has also been applied for preventing the spread of immoral content in social networks [33]. AIaaS can use effective cloud computing and ML models for immoral content detection and eradication. It is highly adaptable, dynamic, and mostly effective for optimizing the outcomes based on big data training data samples.

Since the outbreak of the Covid-19 pandemic, the use of artificial intelligence and machine learning methods to diagnose the disease from chest X-ray images has been expanded. But one of the basic challenges of this field is the need for special and powerful computing resources for image processing. Therefore, the model of AIaaS can be used to reduce costs and eliminate the need for special computing tools, and medical diagnosis can also be made from inexpensive tools such as mobile phones. Moreira et al. [34] proposed a new AIaaS architecture to deliver AI models for embodiment on low-cost devices. They demonstrated the suitability of their architecture through a case study of COVID-19 diagnosis using a low-cost device.

There are also some challenges related to deployment architecture, working mechanism design, and performance optimization challenges specific to AI as a Service (AIaaS) in *edge computing* environments. AIaaS, supported by edge computing, offers the advantage of delivering AI capabilities with guaranteed low latency. This enables the swift implementation of data-intensive and computation-intensive AI applications, while also reducing customer investment costs. To address the challenge, Zhang et al. [35] proposed a configurable model deployment architecture for edge AIaaS and presented a flexible working mechanism by enabling the joint configuration of data quality ratios and model complexity ratios for the AI tasks. Along with commonly used resource allocation operations, they could improve the energy and delay performance of AI services with the desired quality of results.

3. Business roadmap for an AIaaS provider

Business roadmap is a key element in the business strategy that every organization must design to create value enabling growth and development in a competitive environment. The company in our case study has proved itself as one of the top companies in the information and communication technology market in Asia. In order to achieve the strategic goals of the organization and create the top digital ecosystem in the country. this company has designed an AIaaS business model which provides a wide variety of products and services in respond to the ever-changing business requirements of the companies in different industries.

The artificial intelligence services in the company, also known as AIFA,[2] is the main unit in the company which is responsible for developing various AI software products and services with the support of high knowledge and experience of the company's software development unit. AIFA's software products and services are designed and ready to be used in order to take advantage of the capabilities of new technologies to improve the business environment. In line with the company's vision, which is defined as "the platform for creating the future", the AIFA team also has a vision that introduces it as the "artificial intelligence momentum for business transformation" in the region.

When a business plan for AI services is to be defined on a large scale, it is necessary to design a clear roadmap for it to determine the objectives and direction of movements. For this purpose, a two-year roadmap for AIFA's services was determined, which its main objectives are displayed in Fig. 1. In Section 3.1, each of the four AIFA's main objectives for the two proceeding years are described in detail from the perspective of "Marketing and Business Model Design (MBMD)". Next, AIFA main objectives are explicated in terms of "Stakeholders' Responsiveness" and "Selling Products" respectively in Sections 3.2 and 3.3.

3.1. AIFA MBMD objectives

3.1.1. Using open innovation approaches to improve the performance of AI services

Open innovation seems to be an appealing idea for companies seeking for competency in the growing markets. It can be defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively" [36]. Therefore, the use of open innovation was regarded as a key factor to heighten the performance of AI services and make them more competent in the market. The organizational antecedents of a successful open business model in the ICT-based sectors were identified by Najar [37] regarding the benefits of open innovation.

In order to achieve this objective, solutions were developed in two categories: cognitive factors and physical factors. Cognitive factors include developing market knowledge through monitoring industry and competitors, evaluating the potential of the company and its intelligent macro platforms, participating in events, and networking with other ecosystem actors such as universities, research institutes, innovation centers, knowledge-based startups. In the category of physical factors, the justifiability of creating joint consortia was examined, a market research team was formed with the mission of receiving service feedback and increasing customer satisfaction, and RFPs for new needs of the company were developed based on existing markets. Activities such as correspondence with organizations, piloting services, preparing promotional and white papers, producing content on the website and social networks, and designing catalogs, videos, and infographics to market the developed services were on the agenda of the AIFA commercialization team.

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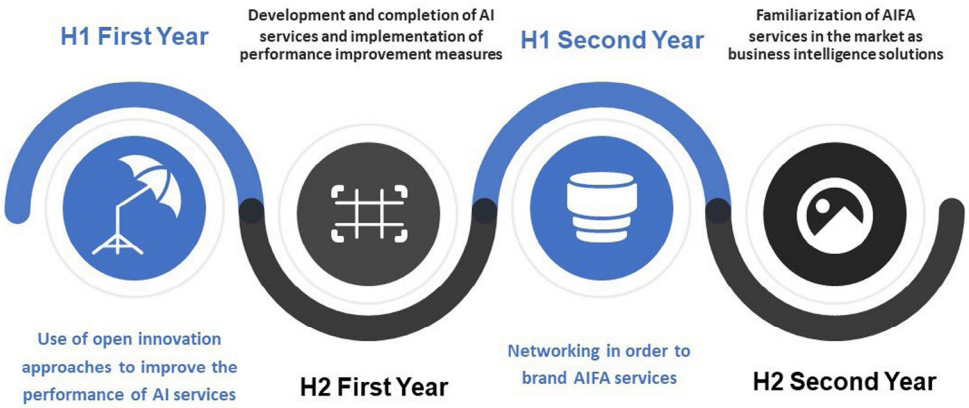

Fig. 1. The company's main objectives for commercialization of artificial intelligence services.

3.1.2. Supplementation and implementation of performance improvement measures

Developing AI services is at the heart of our business model. This is something that is adding value to the company. In this regard, previous experiences and environmental developments were put on the agenda in order to improve the movement in the direction of strategies, agility in providing responds, avoiding insist on implementing incorrect strategies, and avoiding blindly following competitors. Also, the implementation of AI services on a robot named Pepper was also on the agenda as a pilot to determine the feedback on the development of services and to further enhance the capabilities of services in the field of robotics.

3.1.3. Networking in order to brand AIFA services

Networking for branding products and services is one of the critical measures that are considered in the early stages of start-up businesses. Rydehell et al. [38] analyzed how business networks and growth orientation effects on the novelty orientation value propositions for technology-based firms. Participating in conferences, exhibitions and invitations, holding business meetings, holding specialized webinars, and networking with planners through the publication of open problems were some of the activities for AIFA branding put on the agenda in this step. In order to accelerate the recognition and promotion of the brand of AIFA services, digital marketing activities in cyberspace, SEO implementation and producing specialized content, preparing promotional articles in magazines, and holding specialized events and webinars were other activities in this step of AIFA commercialization project.

3.1.4. Market penetration via business intelligence solutions

Learning about the market and receiving feedback on the use of services is a vital matter in order to promote as many products as possible with the purpose of improving customer satisfaction. These measures were put on the agenda in the next step for the commercialization of AIFA services. Commercialization of AI services through the implementation of services on an interactive and social robot is another issue that is on the agenda to increase awareness of AIFA services in the market.

In AIFA roadmap, two more perspectives other than MBMD are considered for the business including "responsiveness to stakeholders" and "selling products" as discussed next.

3.2. AIFA objectives in terms of stakeholders' responsiveness

One of the main roadmap perspectives of AIFA is to achieve the satisfaction of the stakeholders and shareholders. To satisfy this perspective, some important measures were taken in the business model such as creating revenue-generating services in the AI market, creating a branded business in the growing field of AI, developing the company's artificial intelligence brand, focusing on scalability in developing AIFA revenues, and focusing on creating value for all stakeholders. This perspective and the related activities are satisfiable in terms of the main four objectives in the AIFA roadmap for the two proceeding years, as depicted in Fig. 2.

3.3. AIFA objectives in terms of selling products

By selling AIFA services via different solutions in terms of API-based approaches, startup studio, co-creation, B2B, B2G, B2B2C, and also by participating in organizational tenders, it is expected to generate a proper amount of revenue for the AIFA business to compensate for a percentage of costs. This is considered as a set of milestones in the spin-off process of the research center. Moreover, it is regarded as an objective in AIFA roadmap from the perspective of selling products.

4. AI services in the AIFA package

AIFA artificial intelligence services are designed to meet a wide range of business needs in the Middle East region. In designing these services, state-of-the-art technologies, reliability, scalability and customizability have been considered to cover different customers with different degrees of concern and to be able to gain a competitive advantage in the market. An important consideration in the design and development of artificial intelligence services is that there must be a reasonable relationship between the services so that customers who use a specific service do not go to another vendor if they need any related or similar services. Therefore, customer loyalty can be shaped by providing diverse and related services. In this section, we describe the types of services provided and their application in businesses.

Fig. 3 shows the high-level structure of the AIFA AI services. The coherence among the services plays an important role for satisfying customer needs and improving their business performance.

Generally, the AIFA AI services and products are provided in three categories: data-driven systems, machine vision, and natural language processing.

4.1. AIFA's data-driven systems

Data-driven systems can provide the analytics and detection capabilities based on real-time or history data related to a particular application. These systems receive large amounts of data and learn the interesting patterns that might be needed to detect something or predict an event. The detection systems can be used in Financial Services [39,40], Health Care [41], Information Security [42], and so forth. The data-driven systems provided by AIFA include three important services:

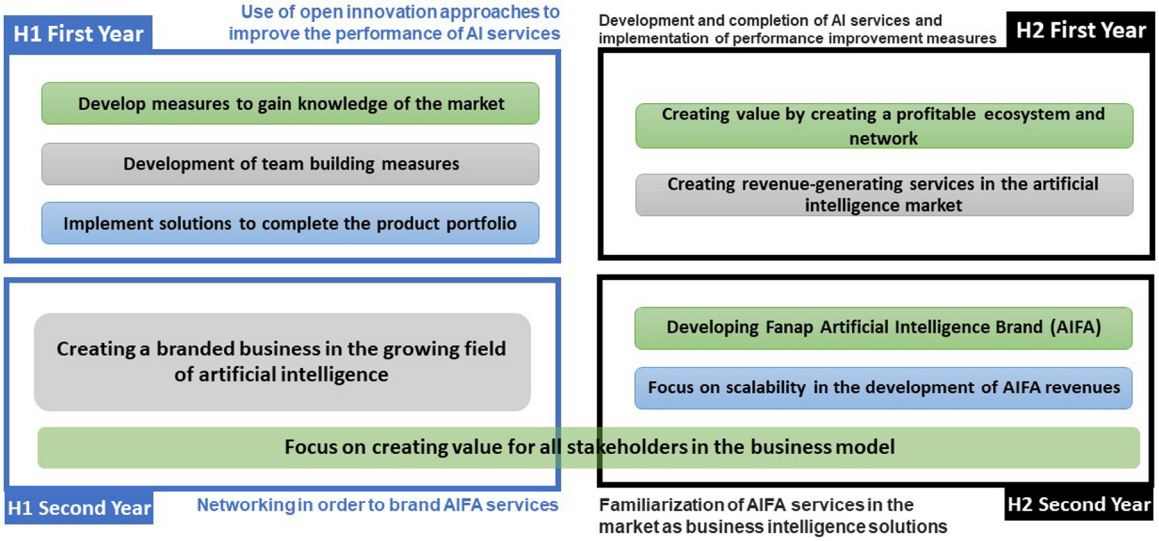

Fig. 2. AIFA commercialization objectives and action plan from the perspective of responsiveness to stakeholders in the first and second years.

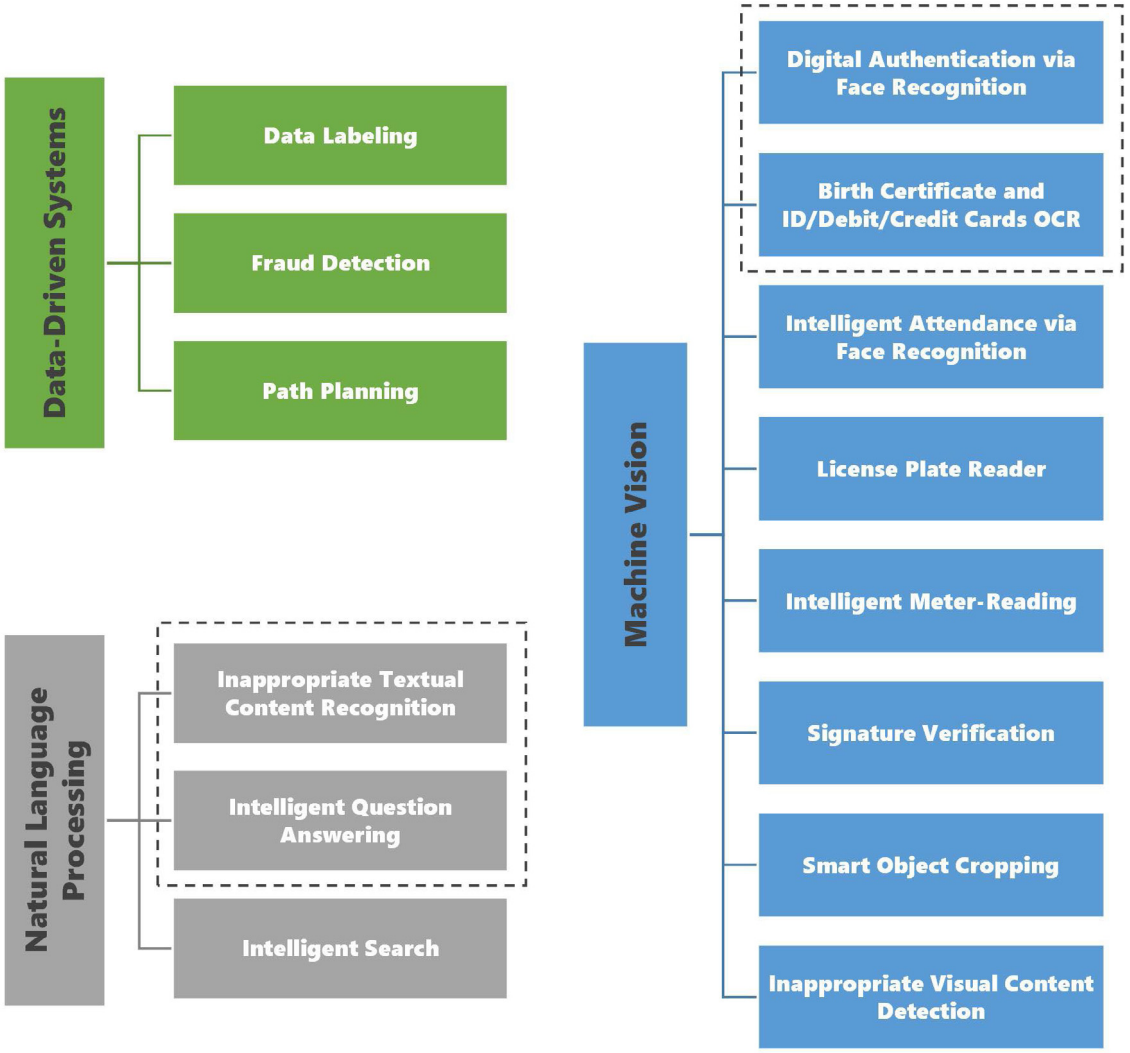

Fig. 3. A high-level structure of the AIFA integrated AI services.

- Crowd-sourcing-based Data Labeling system: The mission of this product is to create a suitable data feed to complete the time-consuming and expensive component of machine learning algorithms, namely data labeling. As a multi-sided platform, this system brings together two or more groups of users: intelligence experts who need tagged data, and non-expert taggers. Two different datasets are already deployed in this system: textual sentiment analysis dataset, and celebrities' image-labeling dataset.
- Fraud Detection system: Using supervised and unsupervised learning algorithms, the system can identify abnormalities in patterns and help detect fraud in financial processes.
- Path Planning: This service is developed with the aim of finding the shortest path in a network of defined nodes.

4.1.1. Data labeling service

Data labeling is one of the fundamental steps in data collection and preparation aimed at defining and differentiating data. Generally, the data used in a particular application is enormous, but the belongness of data samples to a specific class may not be known beforehand. As an example, most automated systems designed to recognize and detect the sensation of images and sounds require a significant number of labeled instances of objects to be taught automatically using artificial intelligence models.

Learning models designed by machine learning algorithms are properly trained if the input data is of high quality and accuracy. Since the data required for supervised learning algorithms requires sample data labeled with classes, their labeling must be determined before implementing any type of supervised algorithm. Determining labels and validating them manually is a tedious and time-consuming task. Therefore, one way to do that is to delegate it to the people through crowd-sourcing [43]. In this way, the accuracy of the input data is evaluated by human knowledge and then high-quality data is used as input for machine learning algorithms.

Although the purpose of labeling is to validate input data, it varies depending on the type of data sets. The AIFA crowd-sourcing data labeling service was founded by the AIFA team with the mission of providing an efficient platform for completing this time-consuming and costly component of machine learning process. The main focus of this service is on the key role of humans in helping to improve the speed, accuracy and quality of data that is used as an input to artificial intelligence algorithms. The labeling service can provide labeling platforms for different use cases such as datasets for recognizing emotions in texts (sentiment analysis) [44], image processing (e.g., face emotion detection), object detection, cancer detection by CT-scans, etc. For example, in the sentiment analysis dataset, the reader's sense is captured when reading some pre-written sentences. In the celebrity datasets, the image of the celebrity whose name is asked in the question is selected by clickers. Finally, the accuracy of the labeled information is evaluated and used in machine learning algorithms. Fig. 4 shows an example of the questions posed for data tagging in the Celebrity Dataset.

4.1.2. Fraud detection service

The rapid growth of e-commerce and the digitalization of financial processes have benefited human society in many ways. But this growth could be a breeding ground for fraud. With the COVID-19 epidemic, online shopping grew at an unprecedented rate, fueling the explosive growth of complex scams and fraudulent transactions. An overview of existing fraud detection and prevention frameworks from a customer-side point of view was presented by [45]. Due to the importance of this issue in business, the AIFA team developed an intelligent fraud detection system. Using big data infrastructure, this system allows for high distribution and scalability of large volumes of banking data. In designing the fraud detection system, various machine learning methods have been used, including supervised learning and unsupervised learning. This system can also detect anomalies in transaction data.

On application of fraud detection system is for detecting fraud in transactions related to bank debit cards. In addition to the fixed rules of the central bank, including the time and place of transactions, the 32 rules of the company based on the number and volume of transactions and the account balance of the customer were used in the system. Also, a number of behavioral abnormalities of the card based on the profile of each card is examined. Then a score is calculated for each transaction showing the probability of being suspicious. The transaction processing infrastructure is designed to detect fragmented transactions in a distributed manner so that the service can support bulk data. This system has been developed in three layers:

- **Offline layer**: Suspicious cases are detected based on the sum and average of deposits, withdrawals in daily, weekly, monthly, and multi-month time periods.
- **Semi-offline layer:** The information which is available immediately after the final record of the transaction is analyzed.
- **Online layer:** Abnormal behaviors are detected by investigating transactions based on data such as behavioral history.

4.1.3. Path planning service

In intra-urban or extra-urban cargo transportation systems, if there is more than one destination, finding the optimal route between the destinations is important. In other words, how and in what order we choose destinations is very important. Momentary traffic in the routes as well as the existence of different routes between the destinations can be reasons for the importance of the order in which they are selected. In the simplest case, the cost can be considered as the length of the path, and the optimal path can actually be the shortest path. It means that the person responsible for transporting the goods would visit all the destinations and finally would travel the shortest possible distance. But today, with traffic, congestion, and other blockages in each route, the optimal route is not only obtained by the shortest paths, but also by the paths that can be traveled faster in terms of time.

AIFA's Path Planning service is able to receive the information about the destinations and the route between them as well as the cost of each route and provide us with the optimal order of navigation through destinations. This service receives destination and route information in the form of a weighted graph and provides the optimal route in the form of a sequence of nodes and edges.

4.2. AIFA services in machine vision

Machine vision is a rapidly growing branch of artificial intelligence (AI) that enables the extraction of valuable information from various visual inputs, including images and videos [46]. It relies heavily on algorithms that transform tacit information from visual data to knowledge and uses image analysis for any purposes that the user might have. What sets machine vision apart from computer vision is the heavy reliance on specific hardware such as processor, sensor, camera, and so on. Machine vision has wide applications in various industrial, financial and commercial sectors. In this section the AIFA services for responding the customer needs in this area are explained.

4.2.1. Digital authentication via face recognition

Face recognition system is a technology capable of recognizing and verifying the face of a person in a digital photo or video, which is usually able to identify the face of people with high accuracy using deep learning algorithms. This technology has received a great deal of attention in recent years in areas such as banking and payment, information security, law enforcement, and sales and commerce. For face image recognition, the person in an input image is identified according to the information in the database. The database contains features of the faces of identified individuals that are used to better train the model. The added value in this section by the company is that AIFA's automatic and intelligent face recognition service can be used to localize people's faces, even in crowded images, and then authenticate

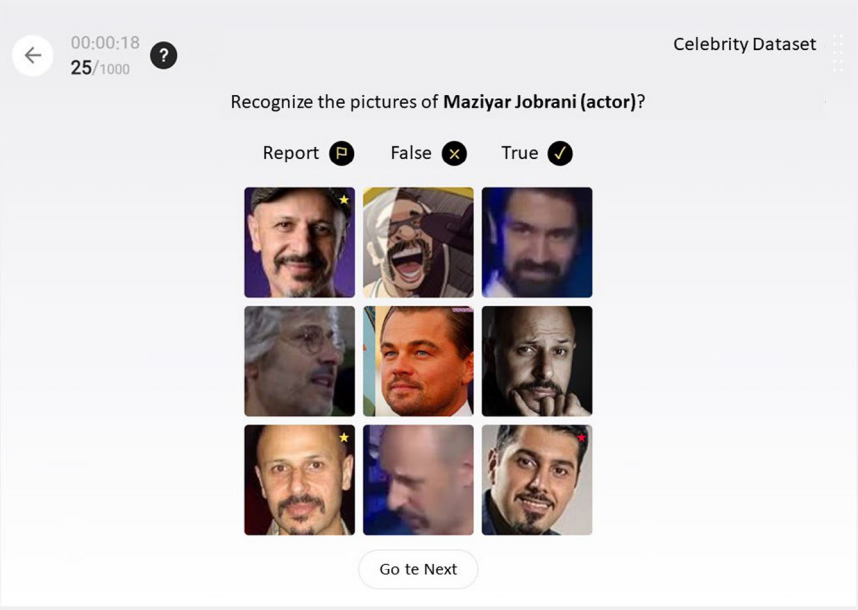

Fig. 4. Data labeling platform sample page for celebrity dataset.

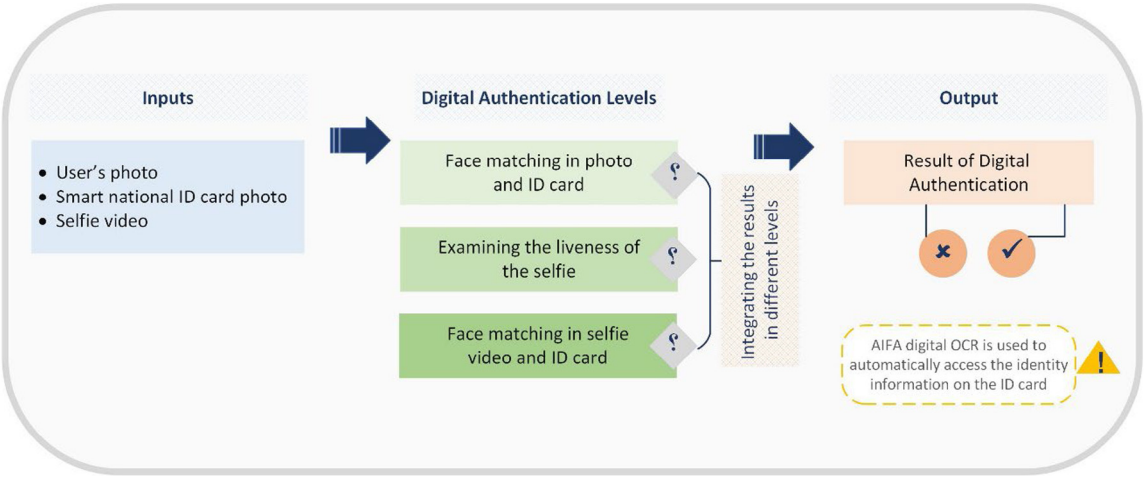

Fig. 5. The digital authentication service process.

them. In addition to face recognition, the intelligent authentication service can recognize the liveness of the received images and in the meantime compare with the images received from other databases such as the registry office.

Image liveness detection in this system is done by receiving Motion Captcha from nodding and blinking movements. This method of recognizing liveness is completely superior to other existing methods such as detecting hand gestures or checking random sentences and words read by people. Because in terms of security, it is possible to detect movements only by the recognized face. The method is not dependent on other parts of the person's body, as it is not possible for other organs have any association with the face.

One of the most important applications of this service is the process of online authentication for KYC (know your customer) activity in financial, banking and insurance systems. The hardware required for this system includes three CPU Servers for registering logs, receiving, and processing requests. Fig. 5 shows the authentication service process.

4.2.2. Intelligent attendance system via face recognition

The AIFA's artificial intelligence team has designed an intelligent automatic detection service that can detect people's faces, even in very crowded images, and identify them. The system is able to detect images of people's faces among hundreds of millions of registered people, almost in real-time. To increase the accuracy and speed of this system, the best deep learning models and image processing technologies in the world have been used. The face recognition and verification service has the capability to record and save the entry and exit logs and the passage time of people in front of the camera in real-time, which can be used to draw the movement routes of people within an organization or considered area. This output can be provided and reported live in the instant-responding system and with a delay of about 15 min in the offline-responding system.

This service requires receiving the personnel codes and photos and preferably a selfie video of them in a specified format. Images in the instant-responding system are constantly received as a stream, and for each frame of the identified people, it logs the entrance time of the people. The instant-responding system is capable of receiving images at a speed of 4 frames per second and a maximum of 4 people per frame. The number of frames, and the number of individuals who can pass in front of the camera in each frame can be increased by upgrading the hardware.

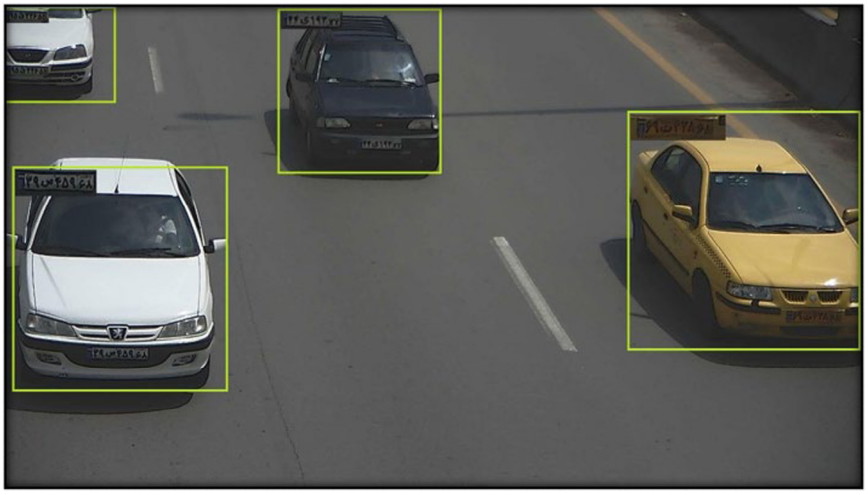

Fig. 6. A sample of a license plate recognition service output.

The benefits of this service include tracking the movement of people and monitoring their traffic, as well as preventing large congestion of employees when entering or leaving the organization. In the future, this service can also be connected to other systems of organizations such as salary and payment system. This service can be connected to the camera online or offline. The other application of this service is monitoring the security of certain places.

4.2.3. Auto license plate reader

Intelligent management of vehicle traffic is one important pillar of urban management, especially in metropolitan areas. It plays an important role in maintaining urban order and security. An *intelligent transportation system* (ITS) involves the use of information and communication technology to improve the performance of transportations. Its refers to a set of tools, facilities and expertise such as traffic engineering concepts, software, hardware and telecommunications technologies that are used in a coordinated and integrated manner to improve the efficiency and safety of the transportation system [47].

In intelligent traffic systems, different technologies are used, from basic systems such as car navigation and traffic light control systems, traffic signs, speedometers and automatic vehicle number identification systems to more advanced and sophisticated systems. They receive and integrate different information from different sources. Most information systems used for weather, traffic, road, and license plate images, can only observe the information and are not able to save or search information they receive. For license plate numbers, there is a need for an intelligent software that processes the images received from the license plate capturing camera and extracts the license plate text information from its image.

AIFA *license plate reader* (LPR) software is an intelligent software whose task is to identify the numbers and letters in the license plates by the image received from a license plate capturing camera. Using advanced image processing and Optical Character Recognition (OCR) algorithms, the license plate number is identified in a short time and converted into text with high accuracy. With this system, there is no need to manually enter or identify the license plate number.

Some features of this service include the ability to detect the type of vehicle, vehicle speed, and location of reading the license plate. This system can be installed and use in parking systems, urban and freeway terminals, and traffic plans. Other features of the AIFA's license plate recognition system include 24-h use in all seasons. The license plate reader service detects any number of license plates in the image and returns its information along with its location. It can also detect numbers when the car moves in any of the four directions. Fig. 6 shows an example of a license plate recognition service output.

4.2.4. Smart meter-reading

When issuing water, electricity and gas bills in the traditional way, first the meter reading officers go to the customer facility and register the number shown in the subscriber meter. This information is then uploaded to the regional company's billing systems and during a process, the company proceeds to issue the bill. These bills are then delivered to the subscribers by the bill distribution agents. This operation takes at least 3 to 4 days and creates overhead costs for the company, which includes on-site reading and in-person meeting or sending texts to distribute the bill. If the bill can reach out to the subscriber sooner, the subscriber will pay the bill faster.

To solve this challenge, the AIFA team has developed an intelligent meter-reading service. In this service, the subscriber records the meter image through the application and send it to the server for processing. The meter image is then processed using an OCR method, machine vision technologies, and deep learning models, and the numbers related to the subscriber's energy consumption are returned to the associated company. These numbers are used to produce the consumption bill electronically.

A unique feature of this service is its compatibility with more than 30 electricity meter models. In order to use this service, the image of the electricity meter must occupy 90% of the user's input image according to the standard designed in the software. Accordingly, the graphical environment of the application is displayed to the user in such a way that the user can adjust the image in a relevant box and edit it. When the physical meter surface is clean and the camera angle and the light is desirable, an excellent input is provided for the software. Therefore, adherence to technical standards in order to respond to the requests of all subscribers is very important.

The AIFA intelligent meter-reading service can be used in two ways: (1) through a payment mobile application, (2) through an API called by the software of any destination business. This service requires a GPU server, a network platform, a camera, and a database system.

4.2.5. Optical character recognition

For most of the organizational processes, identity information such as passport and ID card info is often written down manually. If this is done manually for a large population, it will be very time consuming. Therefore, to make this process more efficient, most organizations use optical character recognition (OCR) systems. Such systems are built using computer algorithms that can transform typed or handwritten text images to their corresponding text characters [48]. Due to the growing importance of digital authentication and its security in smart life, the AIFA team has developed an OCR service for two specific applications:

- **ID card OCR:** Using efficient deep neural network algorithms, this service has provided a secure and efficient platform for virtual authentication based on national smart ID card. For identity verification, first a photo of the person and an image of the national card belonging to him or her are received. The person's photo on the national card is received through the authentication application. The OCR service then reads the barcode on the back of the national card, identifies the individual's national code, and detects the ten-digit code on the national card. AIFA ID Card OCR service is offered for use in mobile operating systems in order easily authenticate the user in banking services, governmental and non-governmental organizations, mobile operators, online businesses and in all diverse service areas where online user authentication is critical for providing services. By minimizing the entry of manual information by the user, this service will improve the customer experience. It should be noted that the national card reader service is a part of the digital authentication service that we explained in Section 4.2.1. In fact, this service retrieves the extracted information through the web service that connects to the Civil Registration Organization by providing the national code and the ten-digit national card code of the photo stored in the database of the Civil Registration Organization. Then, using image processing algorithms, the image from the query will be matched to a photo taken of the person. If these two images match, the identity of the person will be verified and confirmed.
- **Debit/Credit card OCR:** Electronic payment based on bank card information is usually a frequent and time-consuming task for bank customers. Of course, automating this process will be very pleasant and satisfactory for customers. It should be noted that the automation of such a process should be done with security concerns in mind to prevent fraud. To solve this problem, the AIFA team has provided a bank card reader service. This service is similar to the ID card reader service and provides OCR tools in a secure context for reading bank card information based on deep neural network algorithms.

4.2.6. Signature verification

In today's world, signatures are usually considered as an identity proof. All documents created for movable or immovable property and identification documents need to be signed. But sometimes signatures are misused by forgers or fraudsters. Signature verification is a practice in order to determine the match between an individual's original signature and the signature placed in a document, examined by the relevant officers [49]. Many industries such as finance, insurance, forensics as well as public sector organizations use signature verification on a daily basis to verify the identity of individuals in various documents. In order to automate signature verification, advanced deep learning algorithms can be used to perform *supervised* learning on signature patterns.

The company has developed an intelligent signature verification service to prevent counterfeiting and fraud facilitating electronic and in-person authentication. By receiving the link of incoming signatures, this service provides matching or non-matching of signatures as output. In the AIFA's signature verification system, state of the art methods in image processing and machine learning have been used in order to extract and identify the structural features of individuals' signatures. The details of the learning model and its architecture have been described by [50]. This system can be used in different platforms and can even be customized for different applications.

The signature matching system is asynchronous. After calling the service the URL of two signature images that are to be matched is received. Another input to the system is a *packet ID* that acts as a tracker. Then, the signature images are downloaded and processed. The output of the service, which indicates the matching or non-matching of the two signatures, will be delivered. This service requires three CPU servers to set up logs, receive, and process requests.

4.2.7. Smart object cropping

The dramatic growth of competition in the business world has led companies to use different advertising tools in order to overtake their competitors in the market. For designing digital images, one of the most important tools needed by graphic designers is the cropping tool, which helps them create an attractive and effective image. To this end, the AIFA team has designed a service called "Smart Object Cropping" that can be provided to graphic designers as an effective tool in the digital marketing industry. Using machine learning algorithms, this service detects the objects in the image when the user clicks on them in the image and then crops the selected objects [51].

The smart object cropping service is a practical tool for editing photos in online stores and social networks, so that with this product, designers can edit their desired photos faster and spend less time cutting and deleting unwanted objects. Currently, the designed service is available to customers as SDK and Web-based service.

4.2.8. Inappropriate visual content detection

Given the increase in content generated in cyberspace and the spread of their sharing on social networks, it seems necessary to have a tool to detect inappropriate content that is exposed to the public and intelligently restrict access to shared images. The need to use such tools becomes more urgent due to the availability of social networks and Internet-based tools for young people in the age group of children and adolescents. Inappropriate content detection service provides a platform for intelligent and automated filtering of user-generated content on the Internet.

Such implemented service by AIFA is called Not Safe for Work (NSFW) content detection which helps us to identify images that are not suitable for use in the workplace or public space. This service is able to analyze images received in different formats with the help of image processing algorithms. The probability that each image belongs to each of the 5 different classes is determined: two classes of healthy content (drawings and neutral) and three classes of inappropriate content (including hentai, porn and nudity).

This service is asynchronous and receives a digital image link when called. Photos can be found in a cloud-based storage and then be used to call the service. Finally, after downloading the submitted images and processing them, an output will be ready and sent to the address mentioned in the callback. This service can be used in situations where the user uploads a new image to a web service. It can automatically verify that the image is safe and whether it can be displayed to other users. This service can facilitate the work of administrators in social networking platforms to prevent the submissions of inappropriate images, block inappropriate images for the user profile, and securing the visual media platform to avoid the dissemination of inappropriate content.

4.3. AIFA services in NLP

Natural language processing (NLP) is a branch of artificial intelligence that has wide applications in text analysis and knowledge extraction form text content [52] Therefore, it has expanded into various businesses. In this section, three important AIFA services in this field are introduced.

4.3.1. Intelligent Search (IntelliSerch)

Most digital interactions today are based on electronic documents sharing. This has made a large number of documents available to people on a daily basis in various fields. In addition, documents are constantly being produced and added, while new documents are usually of greater importance. Thus, one is faced with a wealth of different information in web-based space to find the information he needs in a particular field. Accordingly, today, large companies and organizations use local search engines to improve intra-organizational performance and provide appropriate customer service. In fact, having a customized

search engine can dramatically increase the speed and efficiency for finding the desired documents.

In order to respond to this need, AIFA has developed the "IntelliSearch", an intelligent search service, based on various text mining methods. This service provides users with an intelligent search engine with various capabilities. It can be used to easily obtain the desired Persian document in a storage and receive the required result. The service combines input text with other complementary data such as user information and search history to analyze and identify user's need for better search. One of the most important features of IntelliSearch is text standardization using various natural language processing methods including stemming, normalization, and tokenization. It can also identify the position of words in the text and give them a proportional importance by Term Weightier. The other features are identifying specific names (Name Entity Recognition), extracting keywords and phrases from the text, comprehending the recorded text based on the extracted language model, high speed and accuracy of the service, expandable database and support for Big Data, prioritizing new and relevant content to the user, text processing in various fields, the ability to customize search and display results, and adaptability based on user behavior.

Intelligent search service has many use cases, including the ability to customize the search process in different areas of an organization by a centralized service, semantic search in organizational documents and letters, categorization and summarization of letters, intelligent and fast question answering in electronic systems, and search on demand in online stores.

4.3.2. Intelligent Questions Answering (QA)

Nowadays, a very high number of users are referring to receive web services from organizations or businesses. This creates a huge number of repetitive questions about how to use online services from users. Thus, the use of organizational services is usually accompanied by various questions, and answering these questions is a time-consuming process for organizations. On the other hand, there are many similar questions and using a common answer for them can reduce the waiting time for an answer. Therefore, in organizations that must answer clients' frequent questions, an intelligent question answering service can be very helpful. In this regard, NLP methods along with efficient processing technologies can be useful in intelligent systematic answers to questions. These methods include sentiment analysis, word weighting, spell checking, keyword extraction, and word lemmatization.

The AIFA intelligent Questions Answering (QA) service has been based built on top of the intelligent search system in order to meet the above needs. There are two main components for this service: The ChatBot service is an intelligent virtual robot that provides a question-and-answer process under a written interaction environment. Also, through the AudioBot service, the user can send his or her question to the system via voice message so that the virtual robot can provide a suitable answer. The QA service answers users' questions by receiving the subject set and its explanation text. The system can display one or more responses ranked by similarity according to the business needs of the output. In this service, questions are asked by voice or text, and the system automatically gives the best answers with the help of Intelligent Search and deep NLP technologies. By gathering the dataset of frequently asked questions from customers and with the ability to receive data on a large volume scale, this service can respond in real-time.

4.3.3. Inappropriate textual content recognition

The pervasiveness and high availability of texts containing inappropriate and uncontrolled content on the web and social networks has created the need to monitor and control the content exposed to the view of children and adolescents. For example, in news websites and social networks, it is important for businesses to detect inappropriate content using filtering services due to the wide variety and scale of comments provided by users. In this way, it is possible to identify and refine texts containing racist, religious and gender-based insults, obscene and immoral words, norm-breaking, deconstructive and anti-value expressions. Inappropriate text content recognition service can provide a platform for intelligent and automated filtering of user-generated content on the Internet.

For this purpose, the AIFA's intelligent detection and refinement service has been provided in the form of two main sub-services:

I. inappropriate phrase recognition sub-service
II. inappropriate phrase refinement sub-service

These two subservices can receive inappropriate words or a combination of them and, while recognizing them, remove these words or phrases from the text. This service can be used in mobile applications, computer games, social networks, blogs, forums, news websites, online shopping websites and online stores, websites and applications for children and adolescents, and advertising networks. Intelligent filtering of comments and captions on social networks is another application of inappropriate text content recognition service. Key features and special advantages of this service include service response time in 10 ms, the ability to work with a dictionary of unconventional words, the ability to add words or phrases, non-dependence on the order of unusual words, the possibility of reviewing large volumes of comments in a short time, high speed of response and recognition of the status of comments and enriching the scope of recognizing unusual expressions using the API. The service is dictionary-based and works with n-grams.

5. AIFA services commercialization

Once AIFA's AIaaS package has been designed, important steps need to be taken to bring them to market. In fact, this is where AI services move from the AIFA lab to the competitive AI market. In order to introduce AI services to the market and attract potential customers, many activities were carried out based on the principles of standard commercialization, which is summarized in this section.

In general, the steps of commercialization of software services and products can be summarized as follows:

I. Ideation: Meeting the needs of users, and reviewing the idea from the perspective of potential users
II. Study the market situation
III. Development of business plan
IV. Absorb capital
V. Software implementation: Planning, process design, solution design, configuration and customization, integration, reporting and documentation, testing, and training
VI. Focus on customer retention and interaction: For this purpose, the following steps are taken:
    - Advertising: This step includes search engine optimization, email marketing, network marketing, article writing and reporting, preparation of advertising teasers, product introduction in reputable publications and magazines (especially publications in the field of information technology and software development), produce creative videos and motion pictures about the product, its functions and how to use it, use graphic design to show the benefits of the product
    - Production of textual content including technical features, capabilities, key product benefits (such as proposal, catalog, brochure, fact sheet, PowerPoint)

In order to facilitate the introduction of AIFA services to organizations and create the opportunity to negotiate for sale, first, the documents related to product presentation were designed for product demos separately. These documents include fact sheet, product catalog,

Table 1
The type of business that were communicated with and the type of AI services.

Business area	Proposed AI services
Bank, payroll and digital wallet	• Intelligent responsive robot • Digital authentication via face recognition • National card OCR software package • Electricity meters Intelligent reading (by OCR) • Fraud Detection
Electronic payment	• checks, bank cards and national ID card reader by OCR • User authentication from the registry office with OCR • Signature verification to verify the account holder's signature • Detection and extraction of national ID on the check using OCR • Electronic authentication of the check's recipient • Detect fraud and misuse of check holder's account
Police	Smart license plate reader
Roads and Urban Development	Digital authentication via face recognition National Card Reader (by OCR) Character Software Package
Municipality	Intelligent responsive robot
Mobile network and internet operator	• Intelligent authentication • Data Labeling System
E-commerce and services	Intelligent detection and filtering of inappropriate textual content
Virtual mobile operators	Digital authentication via face recognition National Card Reader (by OCR) Character Software Package
software companies	National Card Reader (by OCR) Character Software Package Digital authentication service
Government agencies	• Smart electricity meters reading • Intelligent attendance service
Universities	Data Labeling System
Online stores	Smart object cropping service

reportage and PowerPoint presentations. The posts sent on social networks were designed as short texts to introduce the product and their features along with motion graphics. It was also possible to participate in tenders for some products, which was very helpful in identifying and introducing products to customers and the market.

To introduce AI services and features to customers and the market, networking was done with the target organizations. Then letters were prepared and sent to the relevant organizations. Depending on the needs identified in the organizations in question, one or more specific services were introduced to explain the use of the service for the needs of that organization. Therefore, measures were taken in accordance with the standards to introduce services to the market and attract potential customers in several areas.

5.1. Case-based correspondence (to introduce specific services)

In this step, letters are sent to introduce a group of AI services to a large number of organizations and companies that can be potential customers of the services. These letters offer various services related to the type of business and processes of the organizations. Table 1 shows the type of businesses that were communicated with and the type of AI services that were introduced.

5.2. General correspondence to introduce the AIFA business

In this step, in order to introduce the artificial intelligence group (AIFA) and the type of activities in this group, various private companies and government organizations whose problems can be solved using artificial intelligence are selected. AIFA services ware presented and described to them using various presentation methods such as catalogs and brochures.

5.3. Participation in tenders

Taking advantage of the opportunity to participate in tenders in order to actively be identified as a start-up business is very important. Therefore, the products of the AIFA team participated in some selected tenders related to large economic companies which are active in the field of telecommunication and mobile services in order to provide the ground for the introduction of products and services.

5.4. Active presence in social networks

In order to better familiarize AIFA services, social pages were created on popular social networks, such as LinkedIn and Instagram. These pages are currently very active, and several posts related to AIFA products have been provided. Various advertising and educational materials related to AIFA services are posted in these pages so that customers from different parts of the community can be informed and contact the company if necessary.

5.5. Pilot and permanent deployments

Pilot deployment is a pivotal step in the commercialization of each developed software. In this regard, the AIFA team has managed to deploy the following projects:

- The attendance service based on facial recognition in the company's premises as well as in the headquarters of banking service provider company
- License plate reading service in the company's premises
- Digital authentication, ID card OCR, and intelligent question answering services on a social robotic platform
- Intelligent meter-reading service in the company's proprietary mobile wallet (PayPOD)
- Path planning service for the company's smart transportation platform (PODRO)
- Inappropriate content detection service in digital banking ecosystem

It is noteworthy that AIFA deployment activities are not limited to the mentioned pilot activities. Actually, some AIFA services were deployed as permanent solutions for the customer businesses. these services include but not are limited to the following items:

- Digital authentication via face recognition together with liveness detection in the company's mobile wallet and in modern banking platform
- data labeling service for continues improvement
- Real-time fraud detection service for banking transactions
- Smart object cropping system in an e-commerce website builder
- Inappropriate textual content recognition in children entertainment field
- IntelliSearch in video-on-demand platforms (smart TV box) and an eCommerce website builder

5.6. Providing services in an API marketplace

Starting, developing, and running a business require us to create relations with a large chain of businesses, usually in order to provide basic services, infrastructure and support. Many companies and institutions today offer their online services in the form of APIs to other businesses. This Form of service provision is an agile, secure, easy, and scalable method. Since most of the AIFA services are provided in the form of APIs, these services were provided in an API marketplace designed by the company's itself. In this marketplace, in addition to the possibility of comparing and reviewing various digital services, developers can receive the services they need and easily implement them using the available transparent documentation. One of the main sections of the API marketplace is artificial intelligence. Providing cost-effective artificial intelligence services helps businesses grow and develop in this area. Services provided in this area can be accessed from the service request section by creating a business account on the marketplace and calling the relevant API. Digital authentication is another section in the marketplace which is mainly supported by AI services and APIs.

5.7. Commercialization linchpin: Pricing policies

Pricing policies of AIFA products are formulated with regard to two main approaches: on-premises and cloud (SaaS). Both approaches are explained in the following subsections. It is notable that both approaches are considered in parallel with a competition-based pricing approach as a supplementary strategy, characterized by market research.

5.7.1. AIFA on-premises pricing approach

AIFA on-premises pricing approach is generally associated with the licensing situation in which no reselling permission is granted to the licensee. Technically, in this approach the licensor retains an interest in the property being assigned. This is different from the "assignment" approach which is used in some software agreements to transfer the assignor rights in the property being assigned.

AIFA on-promises pricing approach is specified according to a "portion (p)" of the "software production total man-hour value (SV)" and is calculated based on annual tariffs of national ICT Guild Organization. This pricing policy is meaningful for customers who try to determine a feasible threshold to choose between insourcing or outsourcing production schemes. The mentioned "portion" is definable based on the number of selling licenses aimed to cover the production costs of a particular software in addition to the intended profit margin. The general template for calculating software production costs in AIFA is explained in the following based on the calculations of Table 2.

$$\text{Product on-promises price} = p \times SV, \quad 0 < p \leq 1 \tag{1}$$

In Table 2, *E(j)* is calculatable based on the following equation:

$$E(j) = A(j) \times B(j) \times C(j) \times D(j) \tag{2}$$

A(j): Required working weeks for role j
B(j): Dedicated number of team members with role j
C(j): Average dedicated capacity of role j (%)
D(j): Average weekly working hours of role j

Moreover, *T(j)* is the overall hourly wage calculated for employee j based on multiplying three factors (according to tariffs of national ICT Guild Organization). Factors include basic hourly wage (S), specialized profile of human resources ($f_1(j)$), and company profile (f_2).

$$T(j) = S \times f_1(j) \times f_2 \tag{3}$$

Basic hourly wage (S) is calculated according to net hourly wage (nw) after applying waste (w), overhead (oh), and profit margin (pm) coefficients. Net hourly wage (nw) is calculated based on annual wage (aw) in terms of national wage directive after subtracting the costs of housing allowance (ha) and groceries allowance (ga), while applying the decremental effects of paid vacation time off ((v) and official holidays (h) on annual working hours (ah).

$$S = nw \times w \times oh \times pm \tag{4}$$

$$nw = (aw - ha - ga) / (ah - v - h), w, oh, pm \geq 100\% \tag{5}$$

Specialized profile of human resources ($f_1(j)$) is calculated by multiplying coefficients of job category (p_1), job rank (p_2), educational degree (p_3), work experience (p_4), and certificate degrees (p_5).

$$f_1(j) = p_1(j) \times p_2(j) \times p_3(j) \times p_4(j) \times p_5(j) \tag{6}$$

Company profile (f_2) is calculated by multiplying coefficients of company rank (c_1), company field of activity (c_2), and intangible assets (c_3).

$$f_2 = c_1 \times c_2 \times c_3 \tag{7}$$

In AIFA on-promises approach, the customer is responsible to provide the infrastructure, server clusters, the network, and other necessary hardware. Other costs might also apply in this approach for database standardization, or installation of extra servers to decrease the processing queue and improve the responding time. Another instance for applying extra costs occurs when extra cameras are required by customer in intelligent attendance system via face recognition. These types of costs are entitled generally as extra hardware installation fees.

Maintenance and repair cost of AIFA on-promises approach is free in the first year, and 30% of licensing and setup fee applies for the second year. For proceeding years, the inflation rate is also considered in calculating the maintenance and repair cost.

5.7.2. AIaaS pricing approach

SaaS (cloud) pricing approach is the second policy necessary for AIFA products. This approach is required to estimate the price of services per API call. Calculations of this approach are based on two factors: hardware equipment (hw) and software production man-hour value (sw). First, it is necessary to consider the standard response time (rt) to each SaaS request in terms of calling, processing, and responding activities. Then, the breakdown of both hardware and software costs are calculated regarding the standard response time as follows:

$$\text{Product price per API call} = hw(rt) + sw(rt) \tag{8}$$

Hardware cost of each SaaS response is broken down from the overall hardware cost while considering an average useful life (ul) as follows:

$$hw(rt) = sp \times sn \times cn \times (1 + oh \times ul) \times ip / \left(ul_s \times st \times rt^{-1}\right) \tag{9}$$

The variables used in Eq. (9) are explained next:
sp: Server price
sn: Server numbers in each cluster
cn: Total number of clusters
ul: Useful life of servers in years, calculatable via Eq. (11)
ip: Average inflated price coefficient, calculatable via Eq. (10)
ul_s: Useful life of servers in seconds, calculatable according to ul
rt: API response time in seconds

Table 2
General template for calculation of software production costs plus overhead and profit margin.

Cost breakdown structure	Team member role	Variable	Total man-hour	Value
Phase I/ Management Team/ etc.	Project Manager	$j = 1$		
	Technical Leader	$j = 2$		
	System Analyst	$j = 3$	$E(j)$	$E(j) \times T(j)$
Phase II/ DevOps Team/ etc.	System Developer	$j = 4$		
	System Tester	$j = 5$		
SUM			*	SV

oh: Overhead cost coefficient of server maintenance and network requirements (It is equal to 15% in this case study, based on expert judgment)

st: Server busy time coefficient (It is equal to 75% in this case study, based on expert judgment, implying 18 daily hours of full-busy time, or 12 daily hours of full-busy plus 6 daily hours of half-busy time)

From the above variables, average inflated price coefficient (ip) is calculatable based on annual inflation rate ((i) according to the following equation:

$$ip = \left(1 + (1+i)^{ul}\right)/2 \tag{10}$$

Based on expert judgments, approximate useful life is 5–7 (representatively 6) years for 70% of main server parts and 2–3 (2.5) years for the remaining 30% consumable parts. Hence, we estimate the hardware useful life as follows:

$$ul = 0.70 \times 6 + 0.30 \times 2.5 = 4.95\text{years} \tag{11}$$

Software cost, overhead, and profit margin of each SaaS response is broken down from the overall software production value (SV) while considering an average payback period in seconds (pp_s) as follows:

$$sw(rt) = p \times SV \times ip/\left(pp_s \times st \times rt^{-1}\right), \quad 0 < p \leq 1 \tag{12}$$

5.8. Discussion

The commercialization of AIFA services and systems was a rigorous process requiring accurate planning and implementation. In this regard, two types of professional activities for the commercialization of company's artificial intelligence systems were put on agenda. These activities are explicated below in terms of created value streams:

- Direct commercialization activities: These activities mainly include testing and reviewing the readiness of products for commercialization, pricing products, managing the product release activities in an API marketplace, establishing pilot services and systems, managing the content creation process with the aid of open innovation, participating in specialized tenders and calls, and monitoring the competitors and potential customers for AI products.
- Important additional measures: These activities chiefly comprise compilation of AI global market analysis report, market research of data labeling systems, designing the requirements for creating national search engine, investigating trends in the use of AI in industries (including mining, oil & gas, construction, and agriculture), compiling the AIFA roadmap document, articulation of a national AI roadmap requirements, the feasibility study of providing intelligent banking services in metaverse, proposing a plan for the development of an intelligent agent, documenting and publishing 4 technological requirements under the title of AI open issues and RFPs through the innovation support funds and other business networks of open innovation ecosystem, compiling the technical requirements of 2 robotic challenges in mechanized warehouses in the form of reverse pitch events, and selection of suppliers for technical requirements.

As a result of the discussed activities, a managing dashboard to monitor the overall status of AI products is provided. Results of commercialization-readiness tests, the user interface, API status, and testability by users are the other items reported in this dashboard. The summary of dashboard elements besides main AIFA business model attributes are outlined in Fig. 7.

In the future, it is intended to leverage the existing AI products together with the accomplished activities to launch new projects. These projects, which their charters are already published, include the following:

- Intelligent agents for integrated provision of AI services and products
- Customization of an interactive robot to present banking services via AIFA products
- Fraud detection service for banking transactions
- Outsourcing platform of interior and regional AI open projects

6. Conclusion

In today's fast-paced and digitized era, artificial intelligence plays a vital role in increasing the efficiency, performance, and resiliency of businesses. There are few companies that can create AI applications by their development units. Therefore, there should be companies that can provide artificial intelligence services and products in accordance with the needs of businesses. In this paper we presented an AIaaS-based business plan which provides an integrated package of AI products and services for those companies who need AI to develop and improve their performance. A real case study in a company was provided to better reflect our business model as this company is one of the leaders in the field of information technology in Asia. The company's software products and services are designed with capabilities of new technologies to improve the business performance. We described the roadmap, strategy and the requirement behind our model, the structure of the AI package and its features, as well as the commercialization approach and the measures taken to facilitate the journey of the services to the market with standard methodologies. We described how open innovation approaches were used to improve the performance of AI services and how the new products and services were introduced to the market with an efficient and effective manner. The organization of AIFA AI services and products into three categories as machine vision, natural language processing, and data-driven systems helped better marketing activities and finding right customers.

The commercialization package of AIaaS, has its contribution anchored in the integrated promotion of AI products and applications for exterior enterprises in terms of open innovation ecosystem. The strategic approach and systematic roadmap of the real-world case presented here is appliable as a practical tool to pave the way for similar commercialization projects within the field of information and communication technology. It is supposed that the present business model case study is advantageous for those companies and organizations who want to specialize in providing AIaaS or use AI services in their business in an effective manner. The two pricing policies, articulated in the present study in terms of heuristic on-premises and cloud (SaaS) approaches, are introduced as commercialization linchpin. As an implication for contributing to the present research area, it is recommended to investigate the efficiency of these policies in other real-world deployment

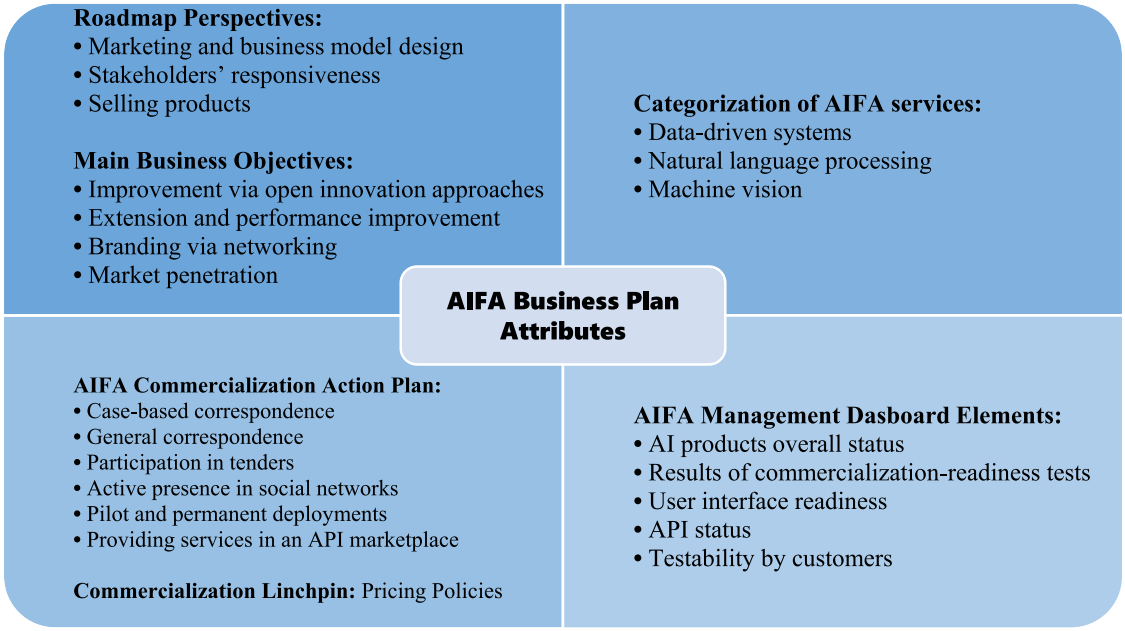

Fig. 7. AIFA business plan attributes and breakdown of elements.

cases. Simulation models such as Monte Carlo are included among the other validation and verification options in this regard. Moreover, another future research implication takes place in applying quantitative performance evaluation models to prioritize the roadmap, objectives, and action plan entries. Multicriteria decision-making methods are among the available models in this regard.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data

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