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INTELIGJENCA ARTIFICIALE DHE NDIKIMI I SAJ NË JETËN E PËRDITËSHME

Arbnor Pajaziti[*], Jozef Kola[**]

[*]*Department of Mechatronics, Faculty of Mechanical Engineering,*
University of Prishtina, Prishtina, Kosovo

[**]*Department of Engineering, Faculty of Applied and Economic Sciences,*
Albanian University, Tirana, Albania

Abstract

Artificial Intelligence (AI) employs sophisticated algorithms to meticulously examine vast datasets, uncovering intricate patterns and establishing fundamental principles. For instance, it autonomously discerns and flags spam emails by assimilating extensive email data, progressively refining its identification process through continuous learning. Similarly, AI is adept at scrutinizing numerous images, effortlessly identifying and categorizing individuals' faces within them. Through deep learning methodologies, AI autonomously hones its analytical prowess by ingesting copious amounts of data, thereby enhancing its cognitive capabilities without explicit human intervention. A notable example is 'Aspect Point Detection' or 'Feature Quantity' analysis, which undergoes evolutionary refinement as the AI algorithms iteratively analyze and adapt to new data inputs.
In this paper through examples of our AI research we will try to explain AI related research history and current status including hardware and software.

Key words: *Artificial Intelligence, Machine Learning, Big Data, Object Detection.*

Introduction

Artificial Intelligence (AI) is a field of computer science focused on creating systems that can perform tasks that typically require human intelligence. In today's world, AI has become ubiquitous, influencing nearly every aspect of daily life. AI powers virtual assistants like Siri and Alexa [1], making it easier to manage tasks and access information hands-free. In healthcare, AI aids in diagnostics, personalized medicine, and drug discovery, potentially saving lives and improving patient outcomes. AI algorithms are used in financial services for fraud detection, risk assessment [3], and algorithmic trading, shaping economic decisions [4]. In transportation, AI is driving advancements in autonomous vehicles, promising safer and more efficient travel [5]. AI-driven recommendation systems personalize our online experiences, from streaming services to shopping platforms, enhancing user satisfaction [6]. AI plays a crucial role in agriculture [7], optimizing crop management, and maximizing yields to address global food security challenges. Smart home devices utilize AI to learn user preferences and automate household tasks [8], enhancing convenience and energy efficiency. AI-driven language translation services break down communication barriers, fostering global connectivity and collaboration [9]. AI-powered content moderation tools help social media platforms manage and filter user-generated content, ensuring a safer online environment. Overall, AI's impact on everyday life continues to grow, transforming industries and reshaping human interactions in profound ways.

Industry 4.0, characterized by the integration of digital technologies into manufacturing and production processes, revolutionizes the way goods are produced and services are delivered [11]. AI plays a pivotal role in this transformation by enabling machines to learn, adapt, and make autonomous decisions. As a result, there is a shift in the labor market towards jobs that require more advanced skills in technology, data analysis, and problem-solving, while routine tasks are increasingly automated. This can lead to both opportunities and challenges for society, such as increased efficiency and productivity, but also concerns about job displacement and the need for upskilling the workforce. Additionally, AI-driven technologies have the potential to enhance various aspects of everyday life, from healthcare to transportation, offering convenience and improved services, while also raising ethical and privacy considerations regarding data usage and algorithmic bias [12].

Big data, from the perspective of an IoT device, encompasses vast amounts of heterogeneous data generated by interconnected sensors and devices, capturing real-time information about the physical world. These data streams often include sensor readings, location data, and environmental variables, enabling insights into patterns, trends, and anomalies for optimized decision-making and operational efficiency [13]. By applying advanced analytics and machine learning algorithms to these diverse datasets, organizations can uncover actionable insights, improve product offerings, and personalize customer experiences. However, managing big data from IoT devices, web scraping, and social media presents challenges related to data quality, privacy concerns, and scalability, necessitating robust infrastructure, data governance frameworks, and ethical guidelines for responsible data usage.

Big data and advanced AI technologies are transforming various industries and enhancing everyday experiences across various domains: human behavior log data, machine operation log data, social media data, and map data [14].

In Section 3 we will use software tools to design an AI application undergoing through data collection, data storing and control, data cleaning and cleansing, data analysis, data mining, data visualization, data integration, data representation.

AI and its subfields

AI, Machine Learning (ML), and Deep Learning (DL) are all terms that are sometimes used interchangeably, although each is a subset of the field. AI refers to intelligence exhibited by machines rather than the natural intelligence produced by entities such as humans.

Many subfields of AI research are based on specific tasks and the application of certain techniques. Reasoning, knowledge representation, planning, learning, natural language processing, perception, and the ability to move and control objects are all conventional goals of AI research. One of the long-term goals of the field is general intelligence (the ability to solve any problem). AI researchers have adapted and integrated a wide range of strategies for problem-solving to address these issues, including mathematical research and optimization, formal logic, artificial neural networks, and statistics, probability, and economic methodologies. Computer science, psychology, linguistics, philosophy, and a variety of other disciplines are all used in AI.

ML is a field that employs various methods to train computers on how to perform tasks for which there is no entirely suitable solution. When there is a large number of possible answers, one strategy is to classify some of the correct answers as legitimate. The computer can then use this as training data to improve the algorithm it uses to identify the correct answers.

In today's world, ML has two goals: one is to categorize data using established models, and the other is to generate predictions for future events using these models. A machine learning system for stock trading, for example, could provide traders with possible future predictions.

DL is a branch of ML, with Neural Networks (NNs) serving as the foundation of deep learning algorithms. With conventional programming, developers create algorithms that use input data to achieve desired results; however, in ML, the generation of software and algorithms is automated.

Object Detection with Deep Learning

Object detection is the craft of detecting instances of a certain class, like animals, humans and many more in an image or video. Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos.

It has applications in many areas of computer vision, including image retrieval and video surveillance. Every object class has its own special features that helps in classifying the class.

For example, when looking for circles, objects that are at a particular distance from a point (i.e. the center) are sought. Similarly, when looking for squares, objects that are perpendicular at corners and have equal side lengths are needed. A similar approach is used for face identification where eyes, nose, and lips can be found and features like skin color and distance between eyes can be found.

DL for face detection is a subset of AI focused on recognizing and locating faces within images or videos, Fig. 1. It relies on NNs, which are computational models inspired by the human brain's structure and function [15]. These networks learn to identify patterns in data through a process called training, where they adjust their parameters to minimize errors. In face detection, Convolutional Neural Networks (CNNs) are commonly used due to their effectiveness in processing visual data. These networks analyze images in a hierarchical manner, extracting features from raw pixels to higher-level representations, enabling them to identify faces with remarkable accuracy. DL models for face detection often employ techniques like region-based convolutional neural networks (R-CNN) or more advanced architectures like Single Shot Multibox Detector (SSD) and You Only Look Once (YOLO) for real-time processing. Data augmentation techniques are frequently applied during training to enhance model robustness and generalization to various conditions and appearances. Face detection models are trained on large datasets containing diverse images with annotated face regions to learn to distinguish between faces and background elements. With ongoing advancements in deep learning algorithms and hardware acceleration, face detection systems continue to improve in accuracy, speed, and applicability across a wide range of domains, from surveillance and security to entertainment and social media.

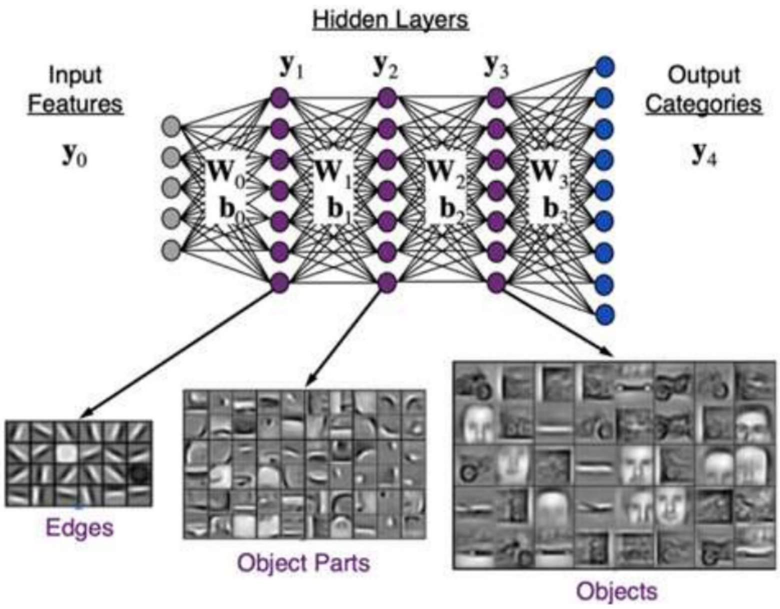

Figure 1. DL for Face Detection [15].

In addition we will describe a CNN, which is a type of DL model commonly used for tasks like image classification, object detection, and image segmentation. The series of layers you mentioned—CONV, RELU, POOL, and FC—are fundamental building blocks of CNNs, Fig. 2. Here's a brief overview of each:

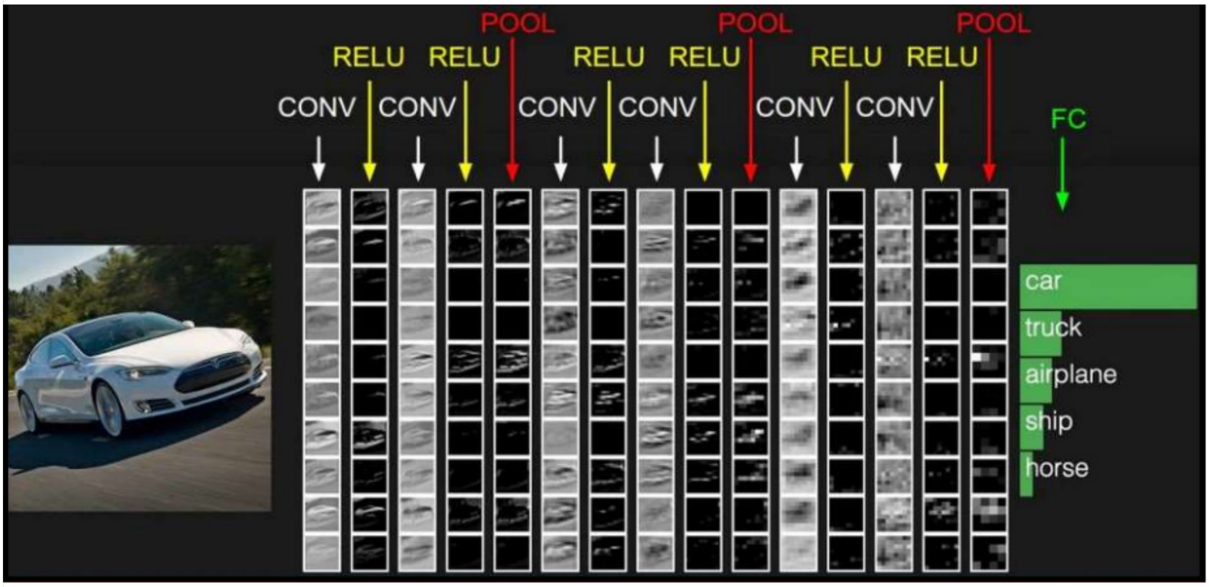

Figure 2. Object detection and recognition [16].

1. CONV (Convolutional Layer): This layer applies a convolution operation to the input, which involves sliding a small filter/kernel over the input image to perform element-wise multiplication and aggregation. Each filter captures different features of the input data, such as edges, textures, or patterns.

2. RELU (Rectified Linear Unit Layer): After the convolution operation, the RELU layer applies an element-wise activation function called the Rectified Linear Unit (ReLU). It introduces non-linearity into the network by replacing all negative pixel values in the feature maps with

zero. This helps the network learn more complex patterns and relationships in the data.

3. POOL (Pooling Layer): The pooling layer performs a down sampling operation by reducing the spatial dimensions (width and height) of the input feature maps. The most common pooling operation is max pooling, where the maximum value within each small region of the feature map (e.g., 2x2 window) is retained, while other values are discarded. This helps in making the learned features more robust to small variations in the input and reduces the computational complexity of the network.
4. FC (Fully Connected Layer): Finally, the fully connected layer, also known as the dense layer, takes the flattened output from the preceding layers and connects every neuron in one layer to every neuron in the next layer. This layer performs classification/regression tasks by combining the learned features from the previous layers and mapping them to the output classes or values.

This sequence of layers—CONV, RELU, POOL, FC—represents the basic structure of a CNN. It's a powerful architecture for processing visual data and has been widely successful in various computer vision tasks.

In Fig. 3 a man is captured walking down a street with a camera in hand in this image. The scene also includes several other individuals walking on the street. The man is wearing sneakers, and there are streetlights visible in the background. Additionally, there are handbags/satchels carried by some of the individuals. The colors in the image are primarily shades of grey, with accents of black. The image features a clear view of a man's face, with an estimated age of 27 and identified as male. The group of people walking in the image appears to be following a particular path or direction.

The Person Identification in the image was done using YOLO V5, which is a popular object detection algorithm. In this case, the algorithm identified multiple instances of people in the image with varying confidence levels. The algorithm was able to detect the presence of people, their positions, and approximate sizes within the image.

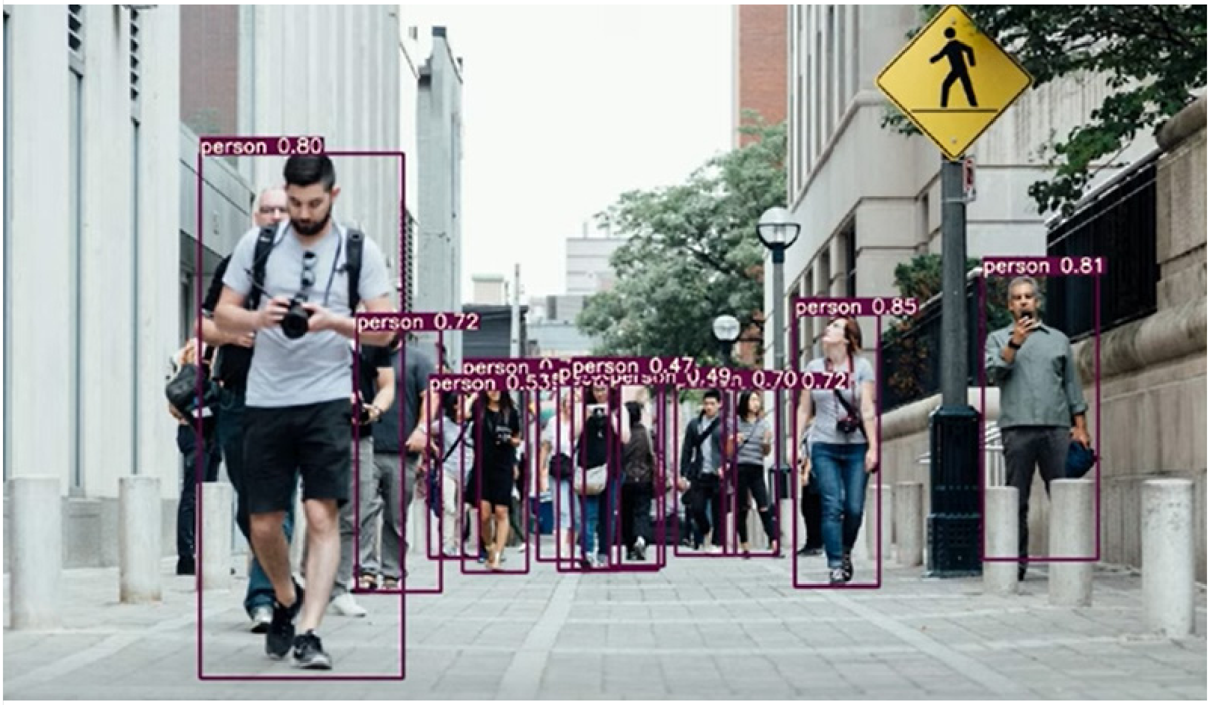

Figure. 3. Person identification with YOLO V5 [16].

In this image, the YOLO V5 algorithm was used to identify and detect various objects, including people, sneakers, streetlights, handbags/satchels, and other items. The algorithm detected the person with a confidence level of 0.93, indicating a high level of certainty in the identification. Additionally, the algorithm identified other objects such as sneakers, streetlights, and handbags/satchels with confidence levels ranging from 0.52 to 0.75. Overall, the YOLO V5 algorithm played a significant role in accurately identifying and labeling objects in this image [16].

Discussions

From above mentioned it is obvious that AI offers numerous benefits to everyday life across various domains. Here are some examples:

1. AI provides personalized suggestions tailored to individual preferences and behaviours, simplifying decision-making in various aspects of life.
2. In healthcare, AI aids in faster and more accurate disease diagnosis, personalized treatment planning, and prediction of health risks, ultimately improving patient outcomes.
3. Transportation benefits from AI-driven navigation systems, traffic management, and autonomous vehicles, leading to reduced commute times and enhanced safety on roads.
4. Smart home automation, powered by AI, optimizes energy usage, enhances security, and streamlines daily tasks for homeowners.
5. Virtual assistants like Siri and Alexa leverage AI to assist with tasks such as setting reminders, answering queries, and controlling smart devices, making life more convenient.
6. Financial services utilize AI algorithms to detect fraud, offer personalized financial advice, and optimize investment portfolios, ensuring more secure and efficient transactions.
7. AI-driven educational platforms adaptively tailor learning content to individual student needs, fostering better engagement and improving learning outcomes.
8. Customer service benefits from AI-powered chatbots and virtual assistants, which handle inquiries efficiently and improve overall customer satisfaction.
9. Entertainment experiences are enhanced through AI technologies, powering immersive gaming experiences and personalized content recommendations on streaming platforms.
10. AI aids in environmental conservation efforts by monitoring natural resources, predicting environmental changes, and optimizing energy consumption for sustainable practices.

From the other side there are some risks of use of AI such as:

1. AI poses risks to everyday life through privacy breaches, job displacement, and biases inherited from training data.
2. Security vulnerabilities and the potential for overreliance on AI systems also contribute to the risks.
3. Ethical dilemmas arise from the use of AI in sensitive areas like healthcare and criminal justice.
4. Unintended consequences and the manipulation of AI for misinformation further compound these risks.

5. Addressing these challenges requires regulatory oversight, transparency, and ongoing ethical consideration to ensure responsible AI deployment.

Conclusion

This paper delves into the societal implications of AI through various examples, leading to the following conclusions:

• Transitioning to roles exclusive to humans becomes a pivotal decision, laden with responsibility amidst AI-generated options.

• AI finds vast application across numerous fields.

• AI significantly enhances quality of life, reshapes job landscapes, revolutionizes work methodologies, and addresses labor shortages.

• Rather than displacing humans from their jobs, AI allows humans to allocate their efforts more strategically, safeguarding human resources.

• Vigilance towards AI risks is paramount.

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