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Application of artificial intelligence and machine learning algorithms as a tool for combating tax and customs fraud in the EU and Serbia

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Abstract

The development of artificial intelligence (AI) and machine learning (ML) technologies has significantly influenced the modernization of tax and customs administrations. Modern administrations increasingly rely on digital tools for processing large volumes of data, risk assessment, fraud detection, and communication with taxpayers and customs users. The application of AI and ML systems enables faster identification of suspicious transactions, automated verification procedures, and more efficient tax and customs control. This paper examines the application of artificial intelligence and machine learning algorithms in tax and customs administrations, with a particular focus on selected European Union member states and Serbia. Special attention is given to the use of risk-scoring systems, automated document processing, AI chatbots, cargo monitoring systems, and digital customs solutions. The paper also highlights the advantages and limitations of AI implementation in procedures related to the prevention of tax and customs fraud. The analysis shows that EU member states have already introduced various AI-based solutions into tax and customs operations, while Serbia has gradually started implementing similar technologies through projects related to risk analysis, e-fiscalization, digital customs systems, and virtual taxpayer assistance. Despite the significant potential of artificial intelligence, its effective application still depends on data quality, transparency, legal certainty, and human supervision.

Keywords: *artificial intelligence, machine learning, tax fraud, customs fraud, digitalization.*

1. Introduction

Artificial intelligence and machine learning technologies are increasingly transforming the way modern public administrations operate. Tax and customs administrations, faced with growing volumes of data, increasingly complex fraud schemes and the need for faster and more efficient controls, are introducing digital tools that enable automated data processing, risk assessment and detection of suspicious activities. In recent years, the European Union has placed particular emphasis on the development and regulation of artificial intelligence systems, recognizing their potential for improving administrative efficiency and combating financial crime.

At the same time, the use of artificial intelligence in tax and customs procedures raises important legal, ethical and operational questions, especially regarding transparency, data protection and the reliability of automated decision-making systems. While some EU member states have already developed advanced systems based on artificial intelligence and machine learning algorithms, Serbia is still in the process of gradual digital transformation of tax and customs administration.

The aim of this paper is to examine the possibilities and current practices of applying artificial intelligence and machine learning algorithms in the prevention and detection of tax and customs fraud, with a particular focus on selected EU countries and Serbia. The paper also points to the advantages, limitations and future challenges associated with the implementation of these technologies in public administration.

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1. Defining artificial intelligence and machine learning

Artificial intelligence (AI) is a broad term that encompasses technologies that enable machines to perform tasks that traditionally require human intelligence. These tasks include problem-solving, decision-making, and learning from experience. AI is not a single technology, but rather a collection of different techniques.

Machine learning (ML) is a subset of AI. It involves training algorithms on data to recognize patterns and make predictions or decisions without explicit programming. For example, an ML model can learn to distinguish between cats, dogs, and people based on images or to understand the content of text (World Customs Organization, 2025).

Although current state-of-the-art AI systems have achieved performance comparable to or even exceeding that of humans in certain areas, they still face significant limitations due to their lack of genuine understanding. This limitation poses challenges for the broader application of AI and highlights the need for further research aimed at equipping AI systems with common sense through the use of knowledge, abstraction, and analogy (Koivisto & Grassini, 2023).

2. Potential use of ai and ml tools in tax administrations in the prevention, detection, and fight against tax fraud

The dramatic advancement of artificial intelligence in recent years has transformed many industries. Artificial intelligence systems can be used to create false documents and fake identities. In addition, fraudsters increasingly use AI to create bots that imitate legitimate users. Such systems can also generate false financial data, which may mislead tax and customs authorities. Fraudsters are now able to carry out complex fraudulent activities within a short period of time. However, as the opportunities for fraud have increased, so too has the capacity of tax and customs authorities to detect and prevent fraudulent activities.

Artificial intelligence-based algorithms can be used to detect fraud and illegal financial activities, as well as to help administrations identify early signs of fraudulent behavior. AI is used in the field of tax fraud prevention and anti-fraud activities in several ways:

- By analyzing large amounts of data. For example, AI tools can identify specific patterns in extensive datasets that might easily be overlooked by human analysts.
- By recognizing patterns of behavior that indicate possible fraudulent activities. This is particularly relevant in cases of so-called carousel fraud. By processing large volumes of information and analyzing models of related business relationships, AI systems can identify anomalies and unusual communication patterns that may indicate criminal intent.
- By enabling faster background checks on taxpayers. For example, when the reported income of an individual or company does not correspond to the accumulated wealth shown in bank accounts or accounting records.
- By informing taxpayers about their tax obligations.
- By resolving queries and assisting taxpayers through virtual assistants or chatbots.
- By encouraging compliance with tax regulations. If irregularities are identified, taxpayers may be discouraged from continuing non-compliant behavior.
- By performing tax risk assessments (risk scoring). These systems identify taxpayers according to the likelihood of non-compliance with regulations and the probability of involvement in fraudulent activities. Artificial intelligence can also be used to create potential fraud scenarios (Necula & Roebling, 2025). One important application involves the use of large language models (LLMs) for the analysis of textual data. Fraud investigations often involve large quantities of text, including forensic materials, financial records, communication data, contact information, and project documentation. Modern LLM technologies can help identify key trends and suspicious communications within such data.
- By screening partnerships and business structures. AI models can be used to analyze partnerships, as an increasing number of businesses are organized in this form, allowing income and losses to be transferred to partners instead of being taxed as corporations. In this way, AI systems can help identify taxable income and detect potential tax fraud.

When discussing artificial intelligence systems and machine learning algorithms applied in tax and customs administrations, we are primarily referring to software systems that are not fully pre-programmed. Such AI systems are capable of independently learning how to generate, provide, and shape responses through the analysis of historical data.

3. Use of artificial intelligence systems and machine learning algorithms in tax administrations in EU countries and Serbia

The use of artificial intelligence (AI) systems and machine learning (ML) algorithms in tax and customs administrations is already present in several EU member states, and publicly available data on these practices can be found through specialized sources such as TaxAdmin.AI.

Austria

The Austrian Tax Administration began applying machine learning algorithms in 2014 with the establishment of the Predictive Analysis Competence Centre (PACC). As a separate unit within the Ministry of Finance, PACC is responsible for the development of AI and ML tools, risk management, improving tax collection efficiency, auditing, and fraud detection. Its activities are organized through four areas: Predictive Analytics, Advanced Analytics, Tax Analytics, and Customs Analytics.

According to reports of the Austrian Federal Ministry of Finance, AI and ML tools are used for several purposes:

- **Web scraping.** The Austrian Tax Administration uses open-source web scraping tools to automatically collect data from websites, commercial platforms, social media, and gig-economy platforms. Prior to the use of these tools, Austria used the XENON system, which was also applied in Denmark, the Netherlands, Sweden, and the United Kingdom.
- **Risk management systems (risk scoring).** These systems classify taxpayers into different risk categories based on red flags and taxpayer characteristics, enabling authorities to select cases for detailed review.
- **Real-time risk detection.** These systems identify suspicious taxpayers or transactions and flag them for further review. Real-time detection is used to pre-screen startups and identify entrepreneurs with a higher risk of tax evasion. The model is also applied to detect and prevent missing-trader and carousel fraud related to VAT evasion.
- **Taxpayer assistance.** The Austrian Tax Administration introduced the chatbot “Fred” in 2019 through the FinanzOnline platform. Fred assists taxpayers with various tax-related questions, particularly those concerning individuals. Since its introduction, the chatbot has reportedly answered more than 3.5 million questions, with approximately 70% of users expressing satisfaction.
- **Taxpayer incentives.** Different communication strategies are used depending on the taxpayer’s profile and assessed level of risk. For example, taxpayers with a history of non-compliance may receive more direct and personalized warning letters. Incentive tools are also used to support communication with vulnerable social groups.

These systems have access to a broad range of data, including tax returns, trade registers, VAT records, tax assessments, and audit information.

Germany

Germany has used machine learning algorithms in fully automated tax assessment procedures since 2016. German tax authorities also apply AI systems in procedures related to issuing, correcting, or withdrawing tax credits. The German tax administration uses AI and ML tools in several areas:

- **Web scraping**. The German Tax Administration developed “X-PIDER,” a scraping and indexing system used to automatically collect taxpayer data from websites, online commercial platforms, and social media. X-PIDER functions as a web crawler capable of identifying websites associated with business activity.
- **Risk management systems (risk scoring).** Machine learning models identify high-risk taxpayers and flag them for further review.
- **Automated tax return verification.** Automated systems process tax returns without human intervention in order to correct, revoke, amend, or cancel tax decisions.
- **Taxpayer assistance.** The virtual assistant “Steuerchatbot” automatically responds to taxpayer inquiries. In addition to German, the system can provide assistance in English and French.
- **Taxpayer incentives.** Similar to Austria, Belgium, Denmark, and Poland, Germany has also experimented with behavioral and communication tools designed to encourage tax compliance.

France

The French Tax Administration (DGFiP) has used AI and ML technologies since 2014 to support various tax administration functions. The main applications include:

- **Web scraping**. DGFiP automatically collects data from websites, social media platforms (Facebook, Instagram, LinkedIn), e-commerce platforms (Amazon, eBay), and sharing economy platforms (Airbnb, Uber, LeBonCoin), comparing the collected data with taxpayers’ declarations. In cooperation with Google, DGFiP also uses satellite imagery and aerial photography to detect undeclared swimming pools, garages, verandas, sheds, and other

property extensions. According to public reports, more than 140,000 undeclared swimming pools were detected in 2023.
- **Social Network Analytics (SNA).** This system analyzes taxpayers' social and business connections in order to identify and visualize potentially fraudulent networks and schemes.
- **Risk management systems (risk scoring).** Taxpayers are categorized according to risk level, after which selected, cases are assigned to tax officers for manual auditing.
- **Taxpayer assistance.** The virtual assistant "AMI" ("friend" in French) helps taxpayers correctly complete tax forms, answers basic questions, and facilitates access to fiscal documentation.

Hungary

The Hungarian Tax Administration has applied machine learning algorithms since 2016. In 2022, it established a specialized Artificial Intelligence Working Group dedicated to the development and integration of AI technologies into tax administration processes. AI and ML systems in Hungary are primarily used for:
- **Risk detection.** These systems identify risk indicators in tax returns and tax documentation. Risk detection models are applied in VAT control, personal and corporate income taxation, as well as in monitoring the transportation of goods through the EKAER system.
- **Risk management systems (risk scoring).** Algorithms classify taxpayers according to risk level in order to select cases for business audits.
- **Taxpayer incentives.** The Hungarian Tax Administration also experiments with adapting communication styles and language to encourage taxpayer compliance.

Bulgaria

In Bulgaria, only a limited number of publicly documented examples of AI use in tax procedures existed up to October 2024.

Transaction Network Analysis (TNA). In 2019, the Bulgarian National Revenue Agency (BNRA) developed a model for the automatic identification of missing traders and carousel fraud. According to reports, the system reduced the average time required to detect missing traders by approximately 15% and increased the number of detected cases.

Croatia

Until October 2024, the Croatian Tax Administration had not broadly implemented artificial intelligence and machine learning systems. However, available literature indicates that Croatia has introduced predictive tools for detecting and preventing carousel fraud.

Among EU tax administrations, Bulgaria, Croatia, Malta, and Cyprus currently demonstrate the lowest level of AI implementation in tax administration processes.

3.1. Use of artificial intelligence and machine learning in the Serbian tax administration

In recent years, the Serbian Tax Administration has gradually introduced digital technologies and modern analytical tools into its operations. Although the level of implementation is still significantly lower compared to some EU member states, certain elements of artificial intelligence and machine learning have already been applied in the areas of risk analysis, taxpayer communication, and fiscal data processing. The introduction of these technologies aims to improve the efficiency of tax control, strengthen the fight against the grey economy, and enable faster processing of large volumes of data.

The most significant examples of the application of artificial intelligence and machine learning in the Serbian Tax Administration include the following:
- **Risk detection.** In 2018, the Serbian Tax Administration, in cooperation with the Faculty of Sciences in Novi Sad, launched an experimental project focused on risk assessment and detection through the use of machine learning algorithms and "big data" analysis as a new approach to processing large datasets. The project was initiated in response to the limited capacities of the Tax Administration and the insufficient number of inspectors. The main objective was to use risk analysis to conduct targeted inspections and achieve better results than random controls. Through the analysis of large databases and the application of artificial intelligence algorithms, the system was designed to identify patterns in taxpayer behavior and detect deviations from standard business practices. In such cases, the system would generate a red flag, indicating the need for further inspection by tax authorities. In 2018, a total of 13,281 field inspections were conducted, which was nearly 5,000 fewer than in 2017, when approximately 18,000 inspections were carried out. At the same time, the amount of newly identified revenue increased by 61% compared to 2017 (Nova Ekonomija, 2019).

- **AI chatbot.** At the beginning of 2025, the Serbian Tax Administration introduced a virtual tax assistant on its official website. The virtual assistant is an interactive tool that enables taxpayers to quickly and easily obtain general information related to the Law on Tax Procedure and Tax Administration and the Personal Income Tax Act. However, it is important to emphasize that the information provided through the virtual assistant is intended solely for informational purposes, is not legally binding, and cannot replace professional legal or tax advice in specific tax situations (Tax Administration, 2025).
- **E-fiscalization** became mandatory in the Republic of Serbia on 1 May 2022. The system involves the use of new hardware and software solutions through which fiscal receipts containing QR codes are issued. Information from fiscal cash registers is transmitted to the Tax Administration in real time. The Tax Administration processes approximately 10 million fiscal receipts daily. By applying machine learning and artificial intelligence algorithms to these large volumes of data, tax control procedures can be carried out more quickly and efficiently (Data Tech International, 2024).

4. Use of artificial intelligence and machine learning algorithms in EU and Serbian customs systems

The use of artificial intelligence represents a significant opportunity for customs administrations, particularly due to the large volume of data generated in customs procedures. Artificial intelligence (AI) and machine learning (ML) technologies enable the analysis of vast and continuously growing datasets in order to detect and predict fraudulent behavior patterns more accurately and efficiently than traditional methods.

The importance of digital transformation in customs operations was emphasized by the World Customs Organization (WCO), whose theme for International Customs Day 2022 was “Enhancing the digital transformation of customs by embracing a data culture and building a data ecosystem.” Digitalization has encouraged customs authorities to cooperate in developing “smart” customs technologies and modern service systems (Cao & Zheng, 2024). As a result, many countries implementing the concept of smart customs have introduced artificial intelligence and machine learning into their customs procedures, gaining valuable practical experience in the process.

Machine learning models can be trained to detect patterns associated with fraudulent activities, such as false declarations, incorrect valuation of goods, and illegal trade. In traditional customs procedures, it often takes several hours to enter and verify customs declaration data, while AI-supported systems can complete these processes in a fraction of the time. Nevertheless, despite the growing role of automation, expert judgment and professional assessment by customs officers remain essential.

China provides an important example of the practical use of AI in customs inspections. Artificial intelligence and machine learning technologies have been integrated into image-recognition systems used in X-ray container scanners (H986), CT devices, and other inspection equipment. H986 scanners are primarily used for the inspection of bulk cargo in land and maritime transport, while CT and X-ray systems are widely applied in passenger control, postal services, and express delivery inspections (Wang et al., 2020).

The rapid growth of cross-border e-commerce has created additional challenges for customs administrations, particularly regarding the detection of smuggled goods in large numbers of packages and the prevention of customs and tax evasion. A standard container X-ray scanner can inspect between 35 and 50 containers per hour, while high-speed package scanners can process up to 2,500 packages per hour. The interpretation of scanned images is a highly demanding visual task, especially because images are often unclear and overcrowded. In such situations, artificial intelligence systems can process and analyze images much faster and more efficiently than humans.

The potential applications of artificial intelligence in customs systems are extensive, and several EU countries have already implemented various AI- and ML-based solutions, including the following:

- **Customs SmartAssist for automated document processing.** This tool combines artificial intelligence, machine learning, and optical character recognition (OCR) technologies to process customs documentation in different formats and quality levels, including handwritten documents, low-resolution copies, and mobile phone photographs. The system improves the classification of goods and the application of appropriate customs tariffs. It was first tested in the United Kingdom in 2024, where it reportedly improved document-processing efficiency by more than 30%, including in complex customs declaration procedures. Customs SmartAssist is currently operational in the United Kingdom, the Netherlands, Belgium, Italy, and Ireland.
- **Risk assessment systems.** Artificial intelligence algorithms analyze shipment data in order to identify high-risk consignments before they arrive at EU borders. These machine learning systems detect patterns associated with potential security threats by analyzing historical data and behavioral indicators, allowing customs authorities to focus inspections on suspicious shipments. Several customs administrations are already testing such systems for risk analysis in customs declarations (Z2Data, 2025).

- **Precise cargo targeting.** Artificial intelligence facilitates and accelerates cargo inspections through the use of scanning and X-ray technologies, reducing the need for physical inspections and enabling customs authorities to focus on suspicious cargo.
- **Product classification.** The use of artificial intelligence in automated product classification improves efficiency, saves time and resources, and reduces the possibility of human error. In March 2025, the Port of Dublin introduced machine learning into its automated classification procedures, reportedly reducing classification errors by 47%.
- **AI chatbots and user platforms.** Customs administrations increasingly use AI-powered communication platforms and chatbots to provide information and assistance to users. These systems require high-quality and reliable knowledge bases in order to ensure accurate and efficient user support.
- **Tracking devices and smart monitoring systems.** Tracking devices such as GPS systems allow highly precise identification of geographic locations. Modern GPS technologies, supported by satellite systems, can determine location accuracy within approximately 30 centimeters, enabling customs authorities to monitor transit cargo movements in real time and prevent route deviations.

These systems are often connected to electronic locks or smart seals that secure cargo containers while simultaneously providing tracking and monitoring functions. In cases of attempted tampering or route deviation, customs authorities automatically receive alerts, helping prevent smuggling and theft of high-tax goods such as tobacco products (Tadatsugu, 2022).

The Serbian Customs Administration, through the eCustoms project and the eCustoms System of the Republic of Serbia, has initiated the modernization and digitalization of customs operations by introducing automated import and export systems, as well as customs decision-management systems. The long-term objective is the establishment of a fully digital customs administration. However, the complete implementation of the project has been postponed until September 2027.

Despite this, several important digital elements have already been introduced:

- **E-declarations and electronic certificates.** The Customs Administration electronically signs customs declarations using qualified electronic seals and delivers notifications of customs debt electronically to declarants and their representatives. The status of declarations can be verified through QR codes within the Customs Administration system.
- **NCTS (New Computerised Transit System).** The European Anti-Fraud Office (OLAF) uses data from the NCTS system, which contains information related to transit, import, export, and customs procedures (IET – Import/Export/Transit). The system processes data relating to consignors and consignees of goods, including both legal entities and natural persons.
- **Electronic cargo tracking devices.** Electronic locators are GPS-based devices used for monitoring cargo movement within Serbia. Their purpose is to improve transport security and prevent illegal trade and smuggling of goods and people.

The electronic locator consists of a housing and a security loop and is connected to the mobile device of a customs officer. By scanning the locator, the transit document, and the rear side of the vehicle, customs officers receive confirmation regarding the consistency of transport data. The device may only be installed and removed by customs officers. In the event of unauthorized tampering or removal of the security loop during transport, the Customs Administration Command Center is automatically alerted (Customs Administration, 2019).

5. Conclusion

In recent years, artificial intelligence and machine learning technologies have become increasingly important tools in the modernization of tax and customs administrations. Their application enables faster processing and analysis of large volumes of data, more efficient risk assessment, improved fraud detection, and enhanced communication with taxpayers and customs users. As digital transformation continues, AI-based systems are expected to play an even more significant role in administrative processes and anti-fraud activities.

The examples presented in this paper show that many EU member states have already integrated artificial intelligence and machine learning into various segments of tax and customs administration, including risk scoring, automated document processing, fraud detection, cargo monitoring, and taxpayer assistance through virtual platforms and chatbots. Although Serbia is still at an earlier stage of implementation compared to some EU countries, important steps toward digitalization and the introduction of AI-supported systems have already been made.

At the same time, the application of artificial intelligence in sensitive areas such as tax and customs control raises important legal, ethical, and operational issues. The effectiveness of AI systems largely depends on the quality, accuracy, and reliability of the data used. Inaccurate or incomplete data may lead to incorrect conclusions and undermine trust in automated systems. For this reason, it is necessary to establish clear legal frameworks, transparent procedures, and appropriate data protection mechanisms.

The growing use of artificial intelligence has also raised concerns among public administration employees regarding possible job displacement. However, AI should primarily be viewed as a tool that supports administrative work rather than replaces human expertise. In tax and customs administrations, artificial intelligence can simplify procedures, reduce errors, and allow employees to focus on more complex analytical and investigative tasks. Final decisions, especially in sensitive fraud investigations, still require human judgment, professional experience, and contextual understanding.

Despite significant technological progress, artificial intelligence still lacks the broader intuitive understanding and reasoning capabilities characteristic of human intelligence. Therefore, the most effective approach in modern tax and customs administration is likely to be a combination of advanced technological systems and human expertise.

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