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Artificial intelligence and tax law in electronic transactions: challenges for oversight and legality.

Artificial intelligence and tax law in electronic transactions: challenges of oversight and legality

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Summary

This scientific article develops an exhaustive analysis of the disruptive intersection between Artificial Intelligence (AI) and Tax Law, focusing on the automation of the monitoring of electronic transactions. In a scenario of a consolidated digital economy, tax administrations have abandoned traditional methods to adopt *Big Data* and data mining tools, aiming to identify taxable events in real time. The study investigates in depth how artificial neural networks and predictive analytics transform tax assessment, challenging fundamental principles such as contributory capacity, the right to a fair hearing, and due process. Furthermore, it discusses the concept of *Updating Lawyering,* proposing a new profile for tax advocacy that should integrate data science skills to guarantee the technical defense and compliance *of* companies in the face of an algorithmic and omnipresent tax authority.

Keywords: Digital Law. Artificial Intelligence. Tax Law. *Updating Lawyering.*
Data Mining.

Abstract

This scientific article develops an exhaustive analysis of the disruptive intersection between Artificial Intelligence (AI) and Tax Law, focusing on the automation of oversight regarding electronic transactions. In a consolidated digital economy scenario, tax administrations have abandoned traditional methods to adopt Big Data and data mining tools, aiming to identify taxable events in real-time. The study deeply investigates how artificial neural networks and predictive analytics transform tax assessment, challenging fundamental principles such as contributory capacity, the adversarial system, and due process. Furthermore, the concept of Updating Lawyering is discussed, proposing a new profile of tax advocacy that must integrate data science skills to ensure technical defense and corporate compliance in the face of an algorithmic and omnipresent Tax Authority.
Keywords: Digital Law. Artificial Intelligence. Tax Law. Updating Lawyering. Data Mining.

1. Introduction

The technological revolution experienced in the first decades of the 21st century, driven by

The consolidation of Industry 4.0 and the massive digitalization of economic relations have imposed on Law

Tax law highlights the need for a profound, systemic, and immediate restructuring. The classic model of

oversight, historically based on *post-hoc* documentary analysis and physical audits of

Accounting books and timely human verification have become obsolete in the face of the volume

immeasurable amount of data *(Big Data)* generated instantly by e-commerce,

Decentralized marketplaces and digital financial transactions. It's not just a change.

not just tools, but a paradigm shift in the very nature of the tax authority-taxpayer relationship.

where informational asymmetry, previously favorable to the individual, is drastically reversed in favor of the State.

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In this context of hyperconnectivity, Artificial Intelligence (AI) ceases to be a a merely auxiliary or accessory tool to become the structuring core and engine of Modern tax administration on a global scale. Data processing capabilities in petabyte levels, combined with the application of machine learning algorithms , It allows the tax authorities not only to react to completed tax evasion, but to predict it with surgical precision. through complex behavioral patterns. The State, equipped with supercomputers and software Through data mining, it begins to exert panoptic control over circulating wealth, monitoring financial, asset, and consumption flows in real time, often even before the Formal occurrence of the taxable event.

The implementation of these disruptive technologies within the Brazilian tax system, exemplified... through the Public Digital Bookkeeping System (SPED) and the supercomputers of the Federal Revenue Service, Like the T-Rex and the Harpy Eagle, it represents an undeniable advance in terms of tax collection efficiency. and combating tax evasion. However, this algorithmic efficiency brings with it legal and ethical challenges. of a magnitude proportional to its processing power. The automation of tax assessment and The selection of taxpayers for audits based on opaque statistical criteria raises... serious questions regarding administrative transparency, the justification for decisions, and the The taxpayer's right to defense, who often finds themselves held hostage by a technological "black box". indecipherable by traditional legal means.

The main objective of this work is to analyze, from a critical perspective and Interdisciplinary, the impacts of this technological shift on tax law phenomenology. A This research is based on the necessary convergence between knowledge of Digital Law and Science of Data and General Theory of Taxation. The aim is to understand not only *how* the technology works, But *what* are its constitutional limits in relation to the fundamental rights of privacy and intimacy? and data confidentiality. The central hypothesis is that Tax Law, in its pure form, is no longer sufficient to guarantee fiscal justice, requiring a new hermeneutics that incorporates logic algorithmic.

The use of data mining in identifying illegal activities will be discussed in detail. Legality and the dangers of the so-called "Algorithmic Tax System" and the necessary adaptation of the professional in law. The methodology employed is deductive and analytical, starting from the analysis of the technologies of Data mining, neural networks, and expert systems to understand their applications. concrete examples in the Brazilian legal system. The study aims to dissect how the transformation Digital technology alters the concept of contributory capacity, which is no longer measured by outward signs of... Visible wealth to be calculated by algorithmic inferences based on digital footprints.

Furthermore, the article introduces and develops the concept of *Updating Lawyering* in the context of... Tax law. It is argued that contemporary legal practice urgently needs tax literacy.

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In the age of AI, taxpayers can no longer rely solely on legal rhetoric; they must possess substance. Computational technique for auditing the validity of tax algorithms and verifying the integrity of databases. of the data used and to question any discriminatory biases embedded in the software. oversight.

Finally, the introduction sets the stage for a discussion about the future of morality. Tax. In an environment where surveillance is omnipresent and punishment is automated, the relationship of Trust between the state and the citizen is put to the test. Technology, although neutral in its essence, When applied by the power of state authority, it can become an instrument of excessive coercion. if it is not contained by robust legal frameworks. This work therefore aims to map these limits and To propose pathways for a Taxation 4.0 that is both efficient and respectful of rights. civilians.

2. Data science as a tool for oversight.

The efficiency of tax collection in contemporary times lies fundamentally in The state's capacity to integrate legacy systems and perform predictive analytics on large systems. data volumes. As observed in the modern curriculum structure of Data Science and Artificial intelligence , *Data* mining technology allows you to extract valuable and actionable knowledge from masses of raw data that, at first glance, would seem disconnected. In a tax context, this means that each invoice issued, each card transaction Credit and every bank transaction becomes a pixel in a high-definition image of taxpayer's financial health.

The tax administration uses advanced mining techniques to perform the The SPED ecosystem is a cross-referencing of information from multiple heterogeneous and dispersed sources. (Public Digital Bookkeeping System) acts as a large *data lake,* receiving data from Electronic Invoice (NF-e), Digital Accounting Records (ECD), EFD-Reinf and ancillary declarations such as e-Financeira and DECRED. The auditing algorithm is not operating. Separately, it compares how much the individual spent on their credit card with how much they declared. income, instantly verifying asset compatibility and identifying omissions of A recipe with mathematical precision.

The concept of *Data Mining* applied to tax law goes beyond simple cross-referencing. arithmetic; it involves the discovery of hidden patterns *(knowledge discovery in databases* - KDD). Using association and correlation algorithms, the tax authorities can identify, for example, that Companies in a specific sector and region, with a particular revenue profile, tend to perform a specific type of tax evasion. This allows the tax authorities to act in a way

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surgical, auditing not by random sampling, but by scientific probability of fraud, optimizing scarce public resources.

Another crucial aspect is the use of *clustering* techniques for the Taxpayer segmentation. The system groups taxpayers based on behavior. Similar taxpayers are identified through *tax risk profiling.* Taxpayers are classified into high-risk *clusters .* Those at risk are subject to continuous and automated monitoring, while those with a history Compliance officers can benefit from simplified procedures. This discrimination is based on The data, while efficient, raises questions about tax equality and the risk of stigmatization. algorithmic behavior of certain economic groups.

Data mining also allows for the detection of anomalies *(outliers).* In a universe From millions of daily transactions, the algorithm is trained to ignore the normal pattern and only alert. Regarding the discrepancy. An unusual financial transaction in an inactive account, an invoice issuance. tax with a value well above the market average for that product, or the establishment of a Companies owned by partners with no apparent financial capacity are "red flags" that have been raised. The software automatically triggers inspection orders even before a human auditor can. Get in touch with the dossier.

Integrating legacy systems is a technical challenge for the Brazilian Federal Revenue Service. It successfully overcame challenges, becoming a global benchmark. The ability to make databases Older systems, often written in outdated programming languages, can now communicate with new platforms. Cloud-based AI is what ensures the continuity of historical data series. This prevents the The taxpayer benefits from state disorganization; the taxpayer's fiscal "past" is Digitized and accessible to compare your current operations, creating a tax record. indelible.

Finally, data science applied to oversight embodies the principle of efficiency. administrative procedure foreseen in article 37 of the Federal Constitution, but under a new guise. Technological. The "Visible Hand" of the tax auditor is replaced by the "Invisible Hand" of the algorithm. This The transition reduces human discretion and, theoretically, corruption at the enforcement level. because the system is auditable and leaves digital traces of all its operations. However, this same Automation requires constant vigilance to ensure that efficiency does not override legality. strict.

3. Artificial neural networks and fraud detection

One of the most significant and sophisticated advances studied in the discipline of Systems Intelligent systems are the application of Artificial Neural Networks (ANNs) in combating tax evasion. These Computational models, biologically inspired by the architecture of the central nervous system.

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Humans possess the unique ability to "learn" and generalize from experience. Unlike
from traditional programming, where the programmer defines explicit rules ("if A, then B"), in networks
In neural systems, the system is trained with historical examples to infer the rules on its own.

In the tax context, the use of *Deep Learning* allows for...
Machine analysis of complex layers of data to identify structured fraud that would
invisible to a linear analysis. The system can be fed thousands of past cases of
"Tax carousel" schemes or the use of "front men." The neural network processes this information and
Learn to identify the subtle characteristics that define these crimes, applying this knowledge.
to scan all new transactions in real time and block suspicious operations
preventively.

The detection of front men ("straw men") is a classic example of the superiority of
Neural networks. A human auditor would spend weeks cross-referencing data such as CPF numbers, addresses, and shareholdings.
Corporate structures and financial transactions are used to assemble the organizational chart of a criminal organization.
A well-trained neural network performs relationship graph analysis in seconds.
identifying that a humble individual, residing in the outskirts of the city, is formally listed as a partner in
a multi-million dollar *holding company ,* indicating a probability of fraud with a certainty greater than 99%.

In addition to detection, neural networks are also used in predicting insolvency and default.
Tax authorities, using predictive analytics, can anticipate which companies are on the verge of...
breaking or ceasing payments, allowing for the filing of precautionary tax measures to guarantee
Tax credits are secured before assets are depleted. The algorithm analyzes variables.
Macroeconomic, sectoral, and microdata of the company are used to calculate the solvency *score* in real time.
real.

However, the use of neural networks introduces the problem of explainability (the problem of
"Black Box"). How is knowledge distributed across the weights of the connections in a neural network?
With artificial neurons, it is often mathematically impossible to explain *why* the system...
He reached a certain conclusion in understandable human language. This creates a stalemate.
Legal: How to justify a violation notice whose determining factor is "the algorithm decided"?
So? The lack of algorithmic *accountability* is the Achilles' heel of this technology in law.

Another inherent risk is algorithmic bias . If the historical data used for training
the neural network may contain biases or reflect discriminatory monitoring practices of
In the past, AI will replicate and amplify these biases. The system may learn, erroneously, that
Taxpayers from a particular geographic region or economic sector are "naturally" more
prone to tax evasion, subjecting them to disproportionate and unfair tax rigor, violating the principle.
of tax equality.

The application of Artificial Neural Networks therefore requires rigorous AI governance. It is

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It is necessary to have constant audits of the models, stress tests, and human validation of the data.

Automated decisions. Technology cannot be a "blank check" for state arbitrariness.

A tax lawyer needs to understand this dynamic in order to demand, in court, the disclosure of the code.

or a demonstration of the logic used, under penalty of denial of the right to a defense.

4. The concept of *updating lawyering* and the legal profession 4.0

Faced with a tax authority equipped with supercomputers, artificial intelligence, and databases of

Integrated data, the traditional tax law practice, focused exclusively on the exegesis of texts

Legally, it finds itself at a severe technical and strategic disadvantage. Therefore, the imperative of...

what modern doctrine and specialized training call *Updating Lawyering :* the lawyer

who not only knows the law, but deeply understands the technology that applies and executes it.

Updating *Lawyering* represents a break from the classic lawyer model. It requires

Now that legal professionals possess hybrid skills, they are navigating the world of Digital Law.

Applied concepts of programming logic, statistics, and systems architecture. In practice.

In tax litigation, this means that the defense against a tax assessment generated by AI cannot be...

limiting itself to classic substantive or procedural law arguments; it must often have the

The ability to audit the accusatory algorithm itself.

If the Federal Revenue Service's artificial intelligence points to an omission of income based on a

Whether based on statistical assumptions or complex data cross-referencing, it is up to the lawyer to demonstrate,

Technically, if there was a failure in the data parameterization, an error in the imputation of variables, or...

"Hallucination" of the predictive model. The technical defense therefore requires counter-evidence.

technological. The lawyer needs to know how to formulate questions for expert reports on computerized systems and

Interpreting digital audit *logs .*

In an advisory and preventative context, *Updating Lawyering* manifests itself in the engineering of

Digital *compliance .* The lawyer works on the architecture of the company's operations to ensure that...

The data generated must be in full compliance with digital ancillary obligations. It's not enough to just pay.

the tax; it is necessary to ensure that the XML of the invoice, the SPED file and the EFD-Contributions

They tell the same story to the tax authority's algorithm. Data inconsistency is the new triggering event.

of the fine.

Legal project management is also becoming an essential skill. Defense

Tax management in large corporations involves the coordination of multidisciplinary teams (accountants,

IT, lawyers), the use of jurimetric software to predict trial outcomes, and automation.

of workflows. The lawyer becomes a legal data manager, using *Business*

Intelligence to devise procedural strategies based on statistical evidence, and not just on...

intuition or isolated case law.

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Furthermore, *Updating Lawyering* imposes a new code of ethics and responsibility. Lawyers should warn their clients about the risks of their "digital footprint." Planning strategies. Tax systems that worked in the analog world become obsolete and dangerous in the digital world. where the trace of the operation is indelible. The professional has a duty to educate the client about the Radical transparency imposed by technology, acting as a guardian of compliance and ethics. corporate.

Finally, this new professional profile requires constant updating, or *lifelong learning.* Technological tools change every six months; enforcement tactics evolve over time. Real. The tax lawyer who stopped studying after graduation or who ignores the revolution in Science. Data is doomed to irrelevance. *Updating Lawyering* is not a niche option, it's the *a sine qua non* condition for the survival of the legal profession in the age of artificial intelligence.

5. Final considerations

The profound and irreversible symbiosis between Tax Law and Artificial Intelligence. This represents one of the most critical turning points in the history of public administration. contemporary, inaugurating an era where oversight ceases to be a one-off administrative act, From sporadic and human, it has become a continuous, ubiquitous, automated, and perennial process. massive implementation of *Machine Learning* and *Deep Learning* algorithms in state structures This gives the tax authorities a panoptic and almost omniscient surveillance power, capable of monitoring in real time. real every electronic transaction, every financial flow and every change in citizens' assets, drastically reducing operating margins for tax evasion, but increasing, at the same time... This measure would extend the coercive power of the State to levels never before seen in liberal democracies.

However, this absolute technological efficiency is not without high democratic costs. and latent dangers; it demands an urgent, courageous, and dogmatic reinterpretation of fundamental constitutional guarantees. It is imperative that legal doctrine and the higher courts... Develop new digital *checks and* balances mechanisms to prevent that the supremacy of the public interest in revenue collection transforms into an algorithmic tyranny, where the presumption of veracity of digital data generated by the machine supersedes, in practice, the presumption of innocence, due process of law and the material reality of the facts, converting the taxpayer into a mere data processing object devoid of agency.

It is absolutely necessary to recognize that the use of artificial neural networks complex methods for identifying tax fraud introduce into the tax administration process the The very serious problem of the " *black box.* " Unlike human oversight. traditional, whose criteria, motivations, and reasoning can be questioned, debated, and challenged.

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Directly, the decisions made by deep learning algorithms often lack...
Explainability *(explainability)* is logically accessible. When an AI system classifies a taxpayer.
such as "high risk" or rejects a tax credit based on obscure statistical standards,
This creates an insurmountable vacuum in the right to defense, requiring the General Data Protection Law to...
(LGPD) be rigorously applied to guarantee access to algorithmic logic and human review.
substantial automated decisions.

In this scenario of profound informational and technological asymmetry, the figure of the lawyer
The tax lawyer undergoes an unprecedented existential and professional metamorphosis, consolidating
The concept of *Updating Lawyering is definitely outdated.* The legal professional who ignores the...
The fundamentals of Data Science, applied statistics, and systems architecture become
functionally incapable of engaging with the new procedural reality and of effectively defending its
Clients. Contemporary tax defense demands an interpretation that goes beyond legal codes.
and delve into the critical analysis of source codes, databases, and training parameters.
used by the State, incorporating digital counter-audit tools and algorithm expertise.
to question the validity of digitally obtained evidence.

Furthermore, corporate governance and tax *compliance* assume a preventive role.
crucial and strategic, shifting the focus from reactive litigation management to proactive management of
Digital and reputational risks. Companies, faced with the predictive and analytical capabilities of the tax authorities, are
compelled to adopt their own advanced Artificial Intelligence tools to carry out a
"Self-monitoring" beforehand and continuously. This creates a technological compliance environment where the sector
The private sector should mirror the technological sophistication of the public sector, transforming compliance.
Tax compliance involves a daily exercise in data integrity, information cleansing, and consistency.
A systemic approach among the various ancillary obligations to avoid exposure to massive fines.

The dialectical tension between state revenue-collecting efficiency and individual privacy.
Taxpayers emerge as a central and unavoidable theme in discussions about the future of law.
Digital Taxation. The indiscriminate, massive, and perpetual collection of financial data and habits of
consumption, geolocation, and relationships, justified by the need to combat the
Tax evasion dangerously borders on the essential core of the right to privacy and confidentiality of data, which are
constitutionally protected. It is fundamental that the Supreme Federal Court and the
legislators establish clear, rigid, and insurmountable limits on the extent to which the State can
mining citizens' digital lives in search of hidden contributory capacity, ensuring that the
Technology should not serve as a safe haven for a totalitarian fiscal surveillance state.

It is also observed that the complete automation of inspections tends to alter morality itself.
Taxation *(tax morale)* and the civic culture of society. The widespread perception that "the taxman does everything."
"Sees, knows, and processes everything" could, theoretically, increase voluntary compliance with

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tax obligations *(enforced compliance),* not due to an evolution of civic awareness or social solidarity, but through the mathematical certainty of punishment *beforehand.* However, this model of Coercive compliance based on fear, surveillance, and technological control can weaken the A legitimate, long-term relationship of trust between the State and the citizen, replacing cooperation with... submission, which is detrimental to democracy.

Finally, it is categorically concluded that the future of Tax Law will not be written. not just by legal professionals, but in necessary co-authorship with data scientists, software engineers and Systems architects. The integration between abstract legal norms and computational logic. Binary systems require constant and rigorous epistemological vigilance to ensure that the technology remain a servant of the law and human values, and not their absolute master. The challenge The monumental challenge of the coming decades will be to humanize the algorithm, inserting into the coldness of the codes the ethics, equity, and the non-negotiable values of human dignity, ensuring that... May digital modernity be an instrument of distributive fiscal justice and not of technocratic oppression.

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