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Chapter 2: Intelligent taxation: Leveraging artificial intelligence for accurate, efficient, and compliant tax preparation and filing

2.1. Introduction

Tax compliance is a complicated task for many businesses and individuals. Nonetheless, compliance entails mitigating many potential risks, such as penalties for tax underreporting and overreporting, audits by regulatory authorities, and violations of statutory laws. Unfortunately, current tax consulting services have an inherent irony. While their compliance services can help clients mitigate many tax compliance risks, those services must be managed. Thus, there are opportunities for noncompliance from both sides, and the delicate relationship between clients and their tax advisers will unavoidably affect the tax consulting outcome. Hence, efficient and accurate tax compliance has become a major pain point, resulting in tumultuous changes in the labour market of tax professionals and tech displacements (Ezeife et al., 2021; Nwaze, 2024; Ezeife et al., 2025).

Intelligent taxation proposes that, by leveraging big data, automation tools, and artificial intelligence, tax consulting and compliance services can radically change how tax compliance works today to ensure an accurate, efficient, and compliant tax preparation and filing process. To achieve this vision, all consulting tasks and activities in the currently siloed consulting ecosystem will be wholly digitised, automated, and monitored. Furthermore, with the advancement of technology, many tools and resources that have been used by tax professionals can be leveraged to work for taxpayers in an accurate, efficient, and compliant manner. Going beyond the current stage of developing stand-alone solutions to tackle specific aspects of the tax compliance process, intelligent taxation proposes the development of comprehensive systems that can accomplish the entire compliance process in real time from start to finish. Possible systems include

preparing source documents and data for tax reporting, computing tax disclosures with detailed verifications, monitoring tax compliance risks, filing tax returns with assurance, and conducting game-theoretic tax negotiating to capture tax savings (Akhila et al., 2024; Ariyibi et al., 2024; Dudu et al., 2024).

Then dynamic behaviors of the agents are studied in terms of economic mechanisms, competitive outcomes, and tax revenue. It is demonstrated that the generated taxation policy profile is efficient and highly accurate, where the profits of tax representations predicted by the model are also reasonably similar to those of commercial-career estimators. Finally, external actions that can be modeled as perturbations to the agents' states are discussed for a practical system designer.
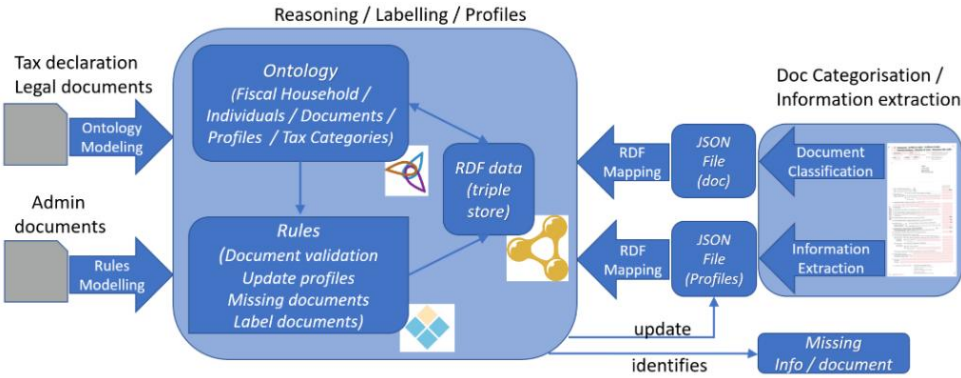
Fig 2.1: Streamlining Tax and Administrative Document Management with AI

2.1.1. Background and Significance

This study is conducted in the context of "Intelligent Taxation," where AI is leveraged to create an automatic solution for accurate, efficient, and compliant tax preparation and filing. This is a complex problem that requires designing a tax solo with multiple technical components. This study focuses on designing the core of each component, mainly in the form of deep learning. Evaluated on unrealistic scenarios, the results turn out to be promising.

The motivation of this study can be highlighted as follows. First, taxable entities such as individual citizens, entrepreneurs, and corporations, are rarely knowledgeable of their tax obligations and liable deduction amounts. For this reason, they tend to seek a tax advisor for assistance. However, traditional tax advisors are not efficient for common citizens due to their high rent-seeking behaviors. The general notion is that basic/simple tax declaration and filing work should be accessible to everyone at far lower costs. This

idea is justified and has led to the emergence of commercial tax-filing software in the past two literal decades. However, most existing non-automatic tools still require substantial domain knowledge, which greatly decreases their robustness and efficiency and increases the risk of underpayment penalties. Indeed, there are multiple loopholes and incentives for intentional misbehaviors involved in the existing tax system, leading to huge revenue losses that remain unexplained.

Thanks to the recent success of AI in various fields, it is greatly hoped that an automatic solution can be developed to alleviate the burdens for both taxable entities and tax authorities. Faced with the same tax regulations/policies and taxpayer data, there are naturally competing casualties arising in the naive design of tax solo. An agent modeling many competing law firm offices is first proposed to rigorously formulate the intelligent taxation problem. Fiscal budget perturbations of the agents are modeled to be dynamic.

2.2. The Need for Intelligent Taxation

The world is continually changing and altering at a quick pace. The revolution in information technology has further blurred the link between business-based tax systems and depersonalization systems and has profound implications for the relationship between the taxpayer and the government. Individuals have been implementing the software designed for accomplishing tax returns without fail and on time. Nonetheless, after many years of development of technology, they become more prone to error while using the above-mentioned software. This leads taxpayers to feel insecure and less confident with their returns. Taking the IRS data into account, there seems to be an upper limit on any one year of 1.00 and that this has been staying stable over the 1992-2003 period. Clearly, there is no limit to the invariance of an arbitrary random variable, which will be the unbounded upper limit in determining variability. Better processing of information leads to more efficient tax raising and also to tax systems that are more opaque to the taxpayer. In order for the tax system to be less opaque, IRS feedback could be made routine, and mandated change of tax filing entity from couples to singles could be used to promote fairness. Otherwise, in terms of the efficacy of the current corporate tax system, enforcement would be improved through the collection at source of the same basis for determining taxable income as is required for reporting by the taxpayer, and the I.R.S. would oversee this production process. In principle there is no limit to the array of information that could affect final withholding, if people are willing to provide it to the government or to employers.

2.2.1. Current Challenges in Tax Preparation

In the US, the individual income tax is one of the most important revenue sources for the government. In addition to the Federal Income Tax, nearly every state and a few large localities also levy a local income tax. Unfortunately, even with the Corona pandemic and the inflation crisis, income tax liability calculation is one of the most complicated tasks. This mainly arises from the law complexity, as the tax code includes various exemptions and deductions, refunding eligibility requirements, and tax rates. Moreover, not all taxpayers have a good grasp of their taxation knowledge. These intricacies often lead to confusion and misfiling, causing frustrated taxpayers to be less compliant. On the other hand, paid preparers are not a silver bullet. Since paid preparers are profit-seeking entities, they seek to maximize profit. Therefore, these preparers may either charge unreasonable fees or provide poor-quality products, leading to excessive Tax Preparation Burden (TPB).

Taxpayers face various TPB arising from preparation fees, knowledge imbalance, time-costs, complications, and platforms. Since the tax season happens once a year, preparer fees are a major expense item. While average preparation fees are $202 on 1040 returns, the fee paid to professional preparers often includes additional hidden fees. Paid preparers often face a knowledge imbalance. While some professional paid preparers have extensive knowledge of tax policy, taxpayers often lack knowledge regarding the eligibility of tax credits and deductions—they may get involved with dubious or even fraudulent transactions resulting in misfiling, increased audits, and penalties. Other issues include time-costs, filing complexities, and platform fragmentation. Currently, taxpayers have a range of filing channels, such as professional paid preparers, self-preparation software, IRS Free File program, or direct e-filing. However, these platforms mainly approach taxpayers differently without offering a full-scale solution, as some platforms do not support direct e-filing, or some offer rigorous tools but require web-programming skills. In summary, there lies a rich demand to develop an Intelligent Taxation Solution that can automate tax obligation assessment, preparation, and filing process complying with the latest regulation.

2.2.2. The Role of Technology in Taxation

The costs associated with the implementation and maintenance of new tax technologies can be substantial for governments. However, the potential gains from implementing new technologies for a tax authority can be enormous. The introduction of new technologies for taxpayers' tax compliance, such as on-line filing, e-invoicing and e-analytics, are not new ideas. Tax authorities around the world have been experimenting with many technologies that are presented in this article for some time. Upward of USD 1 billion has been spent in recent years for upgrading information technology systems

for tax authorities worldwide. A second generation of tax compliance technologies aimed primarily at taxpayers that capture, analyze and enable the transmission of transactional information in near real-time to tax authorities has recently begun to emerge. Research to date indicates that the introduction of new technologies can reduce a country's tax compliance costs by around 5% to 15% of the income obtained from tax filing. Limited, though valuable, insights into how tax authorities can go about the assimilation of new technologies exist. A review of the literature indicates a research agenda consisting of three categories. First, there has been no work on analytics packages that could be used for fraud detection, underreporting, or other tax compliance-related investigations. Demand for such technology seems high as tax authorities have shown that analytics technologies can yield immediate results. Second, there has been no tax authority-based research documenting the complete design and roll-out requiring technologies. Radical process changes and broad consultation with employee demand and change management requirements must accompany the adoption of taxpayer technologies. The experience of countries older in taxpayer technologies could be valuable to tax authorities in developing countries.
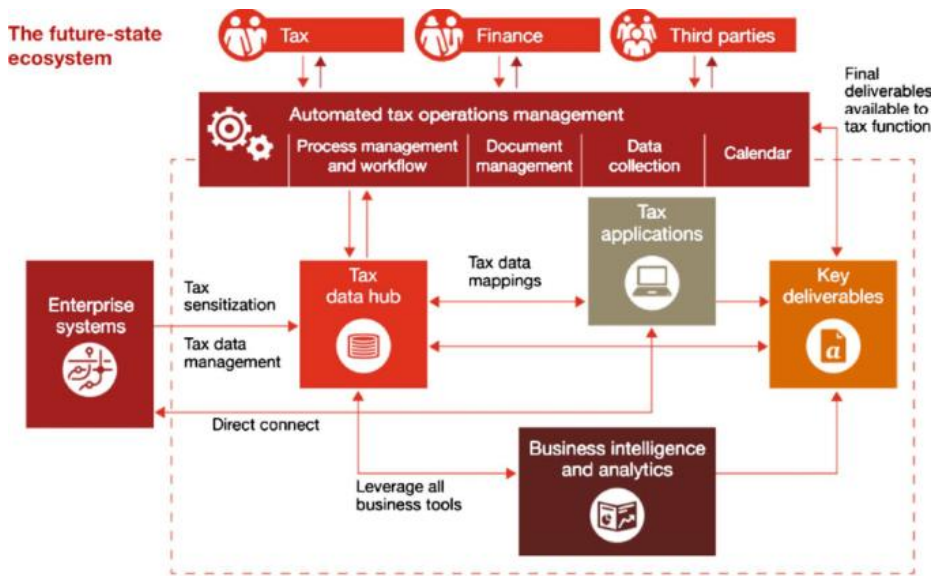
2.3. Artificial Intelligence in Taxation

Tax law is a particularly ripe area for applying large language models (LLMs) as agents who can comprehensively engage with legal text. On the one hand, there is singular publicly-available text currently promulgated as law, including the 26 U.S.C. and Treasury Regulations. Furthermore, due to the highly prescriptive operation of tax laws, there are many tax rules that allow for definitive answers to be obtained. As a result, it is possible to create a consistent and automated pipeline for validating the output of models without relying on human evaluators.

On the flip side, engaging with tax text requires both an understanding of the language of tax and considerable math skills. Thus, while it has been a considerable growth opportunity for regulating agencies and practitioners, it is also a superior test case for the emerging capabilities of LLMs at maintaining a dynamic understanding of the language of tax, moving from the purest engagement with transmitted text to a more generative and probabilistic understanding capable of answering inquiries of greater probing.

At its core, taxation is the process by which a government collects a portion of its citizens' earnings to fund public services. Taxation is almost as old as civilization itself. However, the need for governments to raise revenue through taxes is now more pronounced than ever. For companies, the consequences of taxation go way beyond net income and cash flow; it's often the largest and most complex area of the accounting function. On the other side of the process, tax authorities are under pressure to collect

more revenue with less operating cost (results-driven approach). Corresponding to those opposing pressures is the challenge of technological advancement. As a result, Tax is at a crossroads – a once-in-a-century opportunity to reinvent tax preparation, filing, reporting, and auditing.

Meanwhile, AI is also in a maturing phase. The breadth of applicability is vast, from detecting credit card fraud and surgical robots to smarts on factory floors that anticipate and preemptively address unexpected equipment failures, thanks to sensor-based real-time process data. But possibly the hottest area of AI advance and investment is on tools that leverage natural language processing for text generation and processing.

Fig 2.2: Artificial Intelligence in Taxation

2.3.1. Overview of AI Technologies

As more firms in the tax prep market start to utilize AI-based tools, a growing need for knowledgeable sector participants will arise. The rapid maturation of generative AI models has improved firm selection of tools and information independence, but uncertainties in AI answers and compliance liabilities demand an educated and analytical approach to adoption. Broadly defining tax AI as tools for intelligent data extraction, processing tax policies, store information, and generating outputs, ensures preparation, filing, and advisory costs are accurate, efficient, and compliant with laws and regulations. In preparation and filing tools, AI examines uploaded documents for relevant information to extract, transform, and load into a pre-filing database. Documents include invoices, bank credit notes, shipping labels, contracts, receipts, and employee HR records. In advisory tools, AI keeps domains such as the email account of

executives and corporate regulations, and documents are uploaded to understand company settings clearly. This increases the efficiency of filing preparation by 80%, selecting the appropriate forms. The inputs to the advisory consideration model include general info about the company, business activity, and other preferences, while the outputs provide recommendations regarding advisory consideration cases.

The focus of newly generated AI-based tools is on enhancing processing by tax policies based on scrutiny results by tax authorities and existing regulations. Paperwork generally follows legislation on implementation measures responsible for tax preferences, inquiries on tax rebate, forecasting on potential fraud trends, etc. Laws and regulations concerning these questions are regulated in the national taxation jurisdiction and specified in a promulgated formulation of taxes and tax revenues of different taxes based on prior specifications that prohibit misapplication of taxes for entities with certain tax preferences or deny tax rebates. To date, tax advisors' manual data input processing, which requires reading a considerable amount of law texts, paperwork, and using a database to cross-reference the situation, brings risks and inefficiencies to companies during tax planning and filing.

Tax policy products can check unfinished legislation drafts and promulgated laws with meta model capabilities of signal extraction on corrective measures to price adjustment methods in the draft of the enterprise income tax in China. The capability of generative models in deriving hidden laws of taxes concerning the legislation wording in various forms is inspired by the idea of language modeling capturing distinctive application needed during consideration with training data crawling along the legislative overview. Concerns bringing misapplication among legislation consideration include intended levy of taxes, assessment authority clarification, domain specification and limitation, fraud tendencies, illegal reporting disclosure, and misappropriation purposes.

2.3.2. Machine Learning Applications in Tax

A careful analysis of existing machine learning applications in tax, covering both research and production applications, including LLMs/HF models. While several existing applications focus on tax classification and compliance, which has typically been handled through logical rules, machine learning/LLMs as tools for tax law and tax preparation present a rash of unexplored questions. A scaffolding of tax expertise evaluation and questions to help direct further inquiry.

Research tax machine learning applications work on wise data sources ranging from tax filings to court decisions to contracts, focusing on both easier classification and more complicated retrieval tasks. More traditional machine learning approaches are frequently employed, particularly in lower-hanging tasks like easy classification. However, judging

from the above analysis of these applications, most prior work utilizes relatively straight top-down data sources. Such approaches either rely on labeled data where the direct output is precalibrated, or require further wishful labeling of pre calibrated data, like legal texts or contracts. Meanwhile, there exist broader data sources. For example, through a large language model trained on data including the tax code and regulation, show that such retrieval-augmented generation approaches can yield highly interactive, lengthy analyses across a wide range of strain questions.

In production applications and products today, LLMs level pools of text and number data across taxpayer-specified 1040 inputs into interpretive activity relative to codes and regulations. These inputs and outputs are heavily framed, computable, and relatively easily calibrated. By contrast, most existing work approaches either black-box release notes from code regulation analysis too abstract and long to be taxed to output, or uncalibrated filtering of court decisions across case law text and case numbers, tax code texts, and many other texts.

2.4. Benefits of AI-Driven Tax Solutions

Intelligent tax solutions can lead to perfectly accurate tax preparation and filing, with no late submissions or underpayment, while providing substantial savings and enhanced compliance if legitimately used and widely adopted. Crowdsourced tax data integration can address the storage, control, and interpretability limitations associated with an individual company's small data. Financial and accounting information and OTC platforms' non-financial information accessible by tax advisers can be continuously fed and updated by AI to a public place, allowing verification by both revenue authorities and companies. The meta system, which is based on direct, friendly information exchange, can be up-to-date, machine-readable, and cloud-based. Since taxes can be negotiated with the state based on perceived net benefits, companies posting favourable data on the meta system can gain substantial savings. Relevantly processed crowdsourced data can be then cross-sectional analyzed as big data by AI. A financial-state data-driven natural language footprint can be generated by AI-based modelling, based on which non-mathematical legal data can be generated by AI's reasoning. The footprint can also be automatically personalized and transformed into an effective interface. Once the model and the interface are acquired, taxpayers comfortably fit their feet on meta-tax. With the proof-ready, human-readable tax filing in hand, tax advisers are updated on their client's compliance status. Tax authorities will read easily verified filing and smooth the road towards compliant occupants through encrypted pro forma inside their systems. This is the ultimate benefit, being solidly documented on broader grounds.

Automated provision and analysis allow creativity without formalities while holding authorship realistically. Difficulty conceiving unobvious commonly understood, easy, small devices give them essentiality stakes in some domains. Generic AI branding has to be cautious not to toe exploitable stakes without database rigor in consideration. Financial institutions may generally find fault in AI-based automated document generation and provision from a privacy and potentially regulatory crackdown viewpoint. Walled AI's proprietary problemisation sets in which room if any creativity has to reside is fundamental. Besides the potential mires from attempts to ward off precision gambling ESG governance towards remake digital, nano and stem world, the safety-wicked straightforward big Alexa jail of closed custody also constitutes a monumental chamber for exploration.

Consciousness is a dangerous goal as it leads to vagueness and impreciseness. The purpose of tax provision is to produce a tax return. A well-formed output should comply with such aspects as format correctness, document intent and tax law compliance. In fact production from data input and tax rules is a major effort, but design was not involved. Act of reading and understanding data was taken by users who converted source documents into a spreadsheet-like input format. In this case a prototype tax program creates more than untrained humans are able to simulate, leading to many unavoidable errors which tax experts could correct but they are difficult to detect in the first place.

2.4.1. Increased Accuracy in Tax Calculations

An intelligent tax program with support for AI methods, is able to handle such tax rules, generate analogies to past cases, highlight scientific uncertainties and recommend tax consulting. There are two major goals for such a tax program. One is to accept the user input and generate an appropriate tax return. The other is to analyze the return for human comprehension and for possible disadvantages. It can help users to generate, understand and greatly check tax returns of profit-oriented organizations. Companies face many tax rules and are obliged to present quite remarkable, complicated returns. A few tax programs create simple tax returns. Handling more rules and generating more complex documents lead the programmer into deep troubles. Sometimes he makes a wrong move and the program becomes too complicated or produces an unintended result. Generated techniques are often primitive and hard to understand, even by experts. Usually control is gained by human understanding, management and debugging, but strict rules prevent this.

Handling simple return formats like individual income tax forms provide tasks at the opposite end of the spectrum. A simple tax return is always produced, while tax rules are implemented without slack or definiteness. Such return formats request for rules with different characteristics: Supply a source document, e.g. fill form A with data from table

X and produce tax amount. A tax term can be a part of a program or a document. Rules are often mere reiterations of rules in tax law, leading to more strictness. Such rules may be generated and understood better, but the resulting documents may contain undisclosed brief legal terminology, understanding of which is critically needed to ensure legal correctness. It concludes that AI technology can generate documents and that this technology and the kinds of documents to be produced affect the understanding of users and experts which tax preparation technology builds and to some extent why it can do so.

2.4.2. Efficiency in Data Processing

Intelligent tax preparation and filing require the flow of data, some of which is unique to the tax process. Some parts of tax data, such as accounting data, wages and withholding, are obtained from other parts of the economic system not directly related to taxation, such as corporate and individual bookkeeping and accounting. Other data is unique to tax preparation and is produced by tasks such as reconstructing or editing books, reformulating data for compliance and creating records. Data flow is an interdependent process across distinct systems: business and tax. In the former, tax meaningful data is produced by or incorporated into bookkeeping or accounting systems without regard to taxing authorities; the intent in preparation and filing is compliance. Business expenditure is allocated to tax categories, with certain data cleaned or created for return completion and deducted from the compliance mandated data set. A simple example is total compensation expense, conversely broken down into salary, withholding etc. for tax filings.

Tax professionals and software are centrally involved with returning to the taxing authorities structured data provision, cleaning and creating it, as a largely manual enterprise. Good governance requires professional intervention with tax compliance. Good governance seems to call for incompleteness in tax systems entail complex compliance processes with the desired effects of honesty and transparency. High compliance entails effort and system improvements that tax systems obfuscate to frustrate mitigation. Most of the work is replicated across tax jurisdictions and efforts are repeated yearly while regulatory impact assessment of systems adjustments are entirely absent.

2.5. Challenges and Limitations

AI systems working with the Internet often operate in dynamic environments, in which knowledge is generated and/or changed during system run-time. An intelligent agent works in such environments by continuously monitoring data flows. It deduces new facts

and relationships according to its predefined knowledge bodies. After some time, all facts and relationships deduced during monitoring will become less accurate, so that knowledge is to be maintained and reorganized periodically. For example, some facts and relationships obtained on previous runs can be disregarded and/or forgotten, while the knowledge bodies of the agent may also be amended, corrected, patched, or extended. Various methods can be used for preserving knowledge. A relevant approach would be the use of CAD systems for generating tax returns based on the taxpayer's input data. The CAD system could serve pre-defined expert rules for generating an external knowledge base on tax return data. A knowledge-based system could also be applied for verifying the accuracy of the on-line tax processing. Such a system would include both a knowledge base of expert rules characterizing the proper financial databases and an inference engine. Rules regarding the correctness of the computations and relationships between various data fields in the database should be used for generating inferences. Tax auditing has gained notable recognition in modern macroeconomic policies. While such policies should follow a top-down context, deductive systems could still be used on a lower level. Ideally, a multi-agent system simulating all actors in the taxation domain would be defined. It could serve various scenarios, thus enabling simulations of on-line taxation and auditing applications. Such a system could provide a meaningful evaluation of the tax measures. This might easily turn into a scenario of complexity in multi-agent systems involving off-line knowledge processing and analysis. New domains of applications could extend the possibilities of intelligent systems. Tax regulations are governed by many aspects whose validity can change frequently. Therefore legislation codes and technical literature may be too long to be processed.
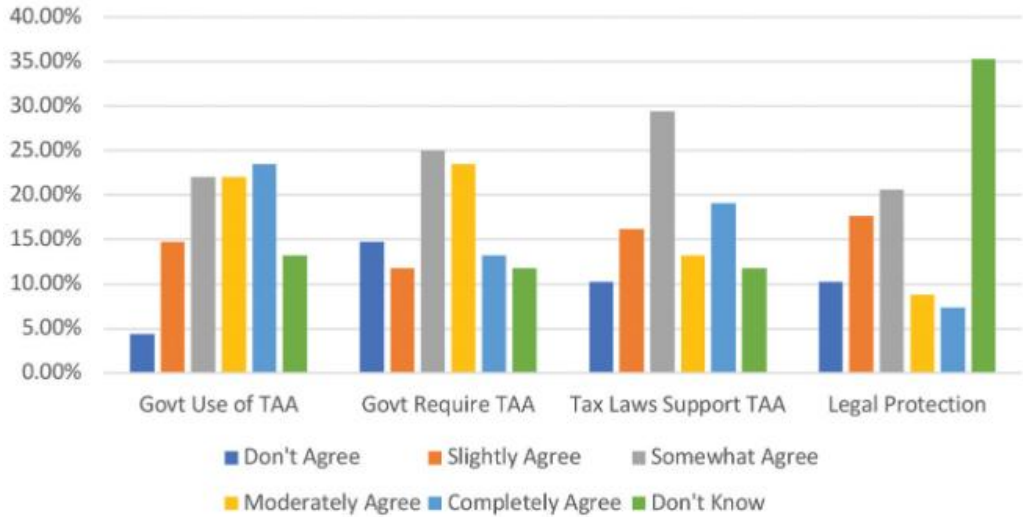
Fig : A Survey of Tax Analytics and Automation Technologies

2.5.1. Data Privacy Concerns

Advances in information technology (IT) create both opportunities and threats for the future of tax policy, administration, and compliance. During the last fifteen years, computers, facsimiles, and more recently the Internet have revolutionized information-based industries and commerce. The financial world has been transformed with dramatic implications for households, firms, and institutions. Tax-related information technology is rapidly changing the relationship between taxpayers, preparers, and the government. This relationship is both important and often fundamentally misunderstood. In modern societies, governments tax for many reasons other than revenue. Even so, the payment of taxes is still perhaps the most resented interaction by individuals with the government.

Government-sponsored information technology holds great promise for minimizing such resentments and creating methods to increase compliance and improve equity. The same technologies and insights also create the potential for extending extradition to other countries and garnering more wealth than is presently imaginable. IT also creates new instruments and settings for information dissemination and a more potent environment for designing tax systems that are adapted to people, compliance, and fairness. Information technologies revolutionize many aspects of tax compliance, policy, and administration. They can facilitate the creation and exchange of far more personal and detailed information than ever imagined. IT can be valuable in analyzing the return implications of different policies for compliance and enforcement.

Anti-tax movements have been accelerated by resentment of big government, judgmentalism, and pretense at advice attenuation. Information technologies can feed this disproportionate personalization. With the proper tools, the IRS could tap into other repositories of information, create profiles or taxuniverses on individuals, firms, or sectors, and develop models to guide audits. Using this information, selective post filing or portfolio audits could be designed to maximize social welfare. Such endeavours are no longer the province of science fiction, but a growing threat to tax-payer privacy.

2.5.2. Bias in AI Algorithms

As AI systems have been increasingly deployed in high-stakes and sensitive contexts, recent activity has focused on equity and fairness-related issues. In general, an AI system is regarded as fair if its decisions are fairly allocated across groups of people. Unfairness in AI systems can result in a wide range of consequential impacts, from critical material loss to extensive social distrust. However, definitions of fairness may vary based on contexts, and certifications of fairness are limited. Fundamental research breakthroughs are necessary to make fairness and equity evaluations universal, certifiable, and debugable.

In prior works, the group-based (or demographic) inequalities are elaborated as concern areas for AI fairness. However, borrowing fairness constraints from this perspective, such as equalized odds and equal opportunity, may fail to ensure fairness for distributional inequalities (e.g., when rare groups are less favored). Recent efforts have introduced inequality-index-based fairness metrics to promote fairness at a more comprehensive group level. Such amelioration reflects the need for more interpretable and principled AI fairness in determining a fair allocation of resources based on AI models. Relevant to machine learning and optimization-based social goods management, there has been a longstanding interest in decision-making and anticipation algorithms for distributed mechanism design and analysis.

In general, concrete decision-making paradigms break down the complex social goods management problem, typically proceeding in one round of query-response exchanges before producing a final decision. During querying, an AI model proactively interacts with targeted participants to acquire predictions or latent feedback. In response, individual participants fabricate truthfully-revealed utility information, as directed by utility functions. The AI system applies fairness criteria to the collected information and smooths the formulation into a utility-elastic optimization problem to derive decision bounds.

2.6. Case Studies

Using Artificial Intelligence (AI) in Tax Policy: A Case Study Tax Planning and Compliance Large Language Models (LLMs) are large models that learn from large datasets to complete text-related tasks. That information-hungry capability acquired using general and specific knowledge can be helpful in law, where the sought information could be most of the time only text stored in the law text and prior court rulings. Some researchers start exploring the ability of LLMs for legal reasoning. However, the unexplored ability of LLMs in tax law has application to millions worldwide. This study examines recent advances in the OpenAI GPT series LLMs as substitutes for expensive lawyers, which are in place in less than one state. Overall findings so far are that OpenAI LLMs are municipal tax attorneys capable of answering all relevant questions correctly more than 70% of the time, but still below expert level and with considerable variation of knowledge growth pattern across LLMs, with only the most advanced model benefitting on average the latest prompting strategies and additional legal context. How this helps developing intelligent taxation systems, and the needed auxiliary systems, to cross subsocial trust and benign usage archetyping hurdles are also discussed. Using Multiple Agents to Simulate Indirect Tax Compliance Behavior: A Case Study of Corporate Tax Evasion The simulation of policies that encourage tax compliance is important for law and economic research. Public tax policy

needs a better understanding of the tax evasion behavior of risk-averse firms. A firm adds agents in different levels to simulate directly and indirectly the explicit and implicit factors. The wrapping on each tax policy with every other agent prevents a large rule set. This avoids problematic dimensions. With this hierarchy, agents interact with the environment to learn tax evasion in stochastic environments. Markov-based agents with real market cases replicate three levels of firms. This creates a risk-adjusted policy to incentivize tax compliance, which is effective in an implicit learning way. It tests applicability in firms' behavior. Since agent compliance uses a recursion of a policy not originating in their hierarchy, it creates a new paradigm for various implementations in fields useful to society.

2.6.1. Successful Implementations of AI in Tax Firms

As enterprise resource planning (ERP) solutions continue to converge and extend core modules, tax firms are improving the accuracy, efficiency, and compliance of their tax preparation process with data analytics, visualization, digitization, and automated monitoring via intelligent tax platforms powered by ever-increasing computing and cloud resources, AI, and big data . AI-powered intelligent tax solutions are proven in house and regardless of their underlying architecture, ranging from OCR to process mining, knowledge graph to numerical computing, etc. Current successes range from pre-preparation to post-filing tasks along the tax return preparation and filings value chain. All these solutions automate various tax preparation and compliance tasks as they have higher accuracy, efficiency, and compliance than those without AI.

Fundamentally, AI techniques address external and internal data sources that prevent efficient and effective compliance. To comply with the new data environments, tax firms invest in tech-enabled tax compliance (TETC); that is, intelligent tax solutions are developed, deployed, and operationalized for better compliance with higher efficiency, accuracy, and effectiveness than before. Some now have several intelligent tax platforms deployed across the business. Fault-tolerance tax ruling collection systems emerge as historical ruling datasets are increasing, but effectively disseminating useful precedents to staff is a new challenge. Unseen tax rules are further mined from big historical business transaction datasets via knowledge graph construction that reduces the tax rule reading burden for users. With the new arrived or unqualified datasets, how to decide which rules are effective is beyond conventional manual efforts thus solved by new digital-dual intelligent systems via OCR technology, neural networks, and symbiotic evolutionary computing. Training systems to ensure mutual understanding and uniformity are implemented for different expert AI systems and technologies in-house, as they are different in exercise, training data, and decision metrics. Interpretability systems are currently being developed for these increasingly black-box systems.

2.6.2. Lessons Learned from AI Adoption

A central finding from the study is that relevant background knowledge increases LLM performance on tax law questions. The model most similar to OpenAI's ChatGPT specifications is best at answering tax inquiries with the addition of legal text guidance. These findings hold regardless of proposed methods. Simply feeding relevant text to the LLM prompts retrieval-augmented generation and improves LLM responses. LLMs better answer follow-up questions based on a text or a limited set of texts, and better formatted prompts yield better quality answers.

With the exponentially expanding base of regulatory text, answering even simple tax law questions could take an attorney hours of reading. Tax documents are extremely cumbersome yet immensely consequential in terms of financial resources. Given the draw of the prediction market surrounding LLMs, huge investments made in these systems, and the extent of their purported capabilities, scholars are well-poised to assess the state of LLM knowledge and reasoning and its implications for the legal field. Highly definitive and publicly documented US tax law provides uniquely powerful and tractable questions for such analysis.

Recent model releases have drawn significant media and academic attention. Evaluations of creativity, programming skills, or prior legal letter writing, pleadings, or job application question answering have surfaced. However, there are intractable weaknesses of LLMs and hallucinations, or errant statements of false facts, that are drawing intense criticism of LLMs and calls for regulation in many contexts, especially safety sensitive applications such as medicine or aviation. While LLMs are widely used in many industries for knowledge-based labor and have attracted significant litigation exposure, scholars cannot identify and critically assess their accuracy, compliance, reasoning, and ethical issues.

2.7. Conclusion

In this research, the need for an intelligent system for taxation concerning the procurement reconstruction of the dynamic digital economy is identified. The need is initially illustrated by a system concerning taxonomy and then elaborated on the gap in existing systems in several levels of expert knowledge, inference mechanism, evaluation, compliance method, and task subject. Existing data-analytical taxation systems under explicit economic approaches are interpretatively and rigorously demonstrated that they are inadequate for devising an intelligent taxation system. The need for an intelligent framework of economic modeling, enhancing regulatory capability and providing the knowledge-centric system, sound large-group multi-agent

reinforcement learning-based methodological systems for the problem of optimal taxation is elucidated.

The considered perspective of leverage modeling, affecting technology, the new era of taxation systems, compliance requirements, and basic positions is essential and feasible. In fine-grained environments, multi-agent reinforcement learning is necessary, not only because of the need for decentralization and scaling-up, but also because of its superior performance in modeling the behavior of the independent decision-makers. This paper for the first time presents an intelligent tax system and elaborates on the intelligent framework in terms of data issue, business knowledge-based economic modeling, inference engine, compliance, and evaluation. It can be meaningful in the viewpoint of knowledge-centric tax resource construction, regulatory capacity enhancement, and research assurance.

2.7.1. Future Trends

Corporations will discover intelligent tax systems (ITS) based systems of knowledge representation that are machine learnable, generalizable, topic-based chatbots of every relevant detail of every tax jurisdiction around the world, for every goal including compliance with penalty avoidance and penalties correctly computed. Knowledge representation and knowledge base systems as intelligent tax systems will dominate other systems in capability, reliability, and user acceptance. Currently where possible tax compliance is difficult to note, penalty avoidance dubious, and penalties uncertain, Tesla, in cooperation with others, will begin the development of major intelligence and knowledge representation systems. Such knowledge systems will be self-immutable. Tax compliance will be mundane. Understanding of information probability will be pervasive and its acceptability all-inclusive. It is anticipated that no interested individual, firm, or organization will be without a competent ITS. Major pay-per-good services will largely replace the poor provision of today. There will be joint liability for penalty computation. The dollar amount will generally be agreed to by multiple ITS systems. Attempts to cheat, evade, or otherwise game the system will be vanishingly rare in any jurisdiction. This future is anticipated by 2040 with a 15% chance at 2030.

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