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USE OF ARTIFICIAL INTELLIGENCE FOR SMART CONTRACTS AND BLOCKCHAINS

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Overview of Smart Contracts and Blockchain

Currently, smart contracts are gaining prominence because of the emergence of blockchain technology and the popularity of cryptocurrency. In particular, there is more acceptance of the verification of transactions on a public or private blockchain. One notable legal change in corporate law related to blockchain which may therefore spur more use of smart contracts is the Delaware Blockchain Initiative and the amendments to the Delaware General Corporation Law, which among other things permits issuance of distributed ledger shares.[i]

A blockchain is a sophisticated technology for a distributed ledger, that in theory more securely records transactions. In essence, smart contracts are programs that execute based on parameters agreed to by two or more counter parties. Smart contracts may either be coded entirely in standalone software, coupled with a traditional agreement, or partially governed by rules agreed to by the parties. Their use has been limited due to the sophistication of the program, but with wider acceptance and more use of AI, smart contracts may be able to encode and verify on a blockchain more complicated commercial relationships between parties.

Smart contract technology abounds, and includes the popular Ethereum platform, which permits smart contracts to execute on the nodes in the Ethereum network and also to operate with the Ether coins.[ii] Other players in the eco-system include the POA Network which enhances

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the Ethereum technology[iii], Etherparty, a smart contract creation system[iv], and the Agrello foundation which aims to provide legally binding smart contracts powered by AI.[v] Smart contracts have been used or are proposed to be used in various industries[vi]; for example: (a) to automate sharing, payments and rentals; (b) to provide flight insurance; (c) in the insurance industry[vii]; (d) for bills of landing[viii]; (e) in the energy industry[ix]; and (d) for selling real-estate.[x]

The potential for revolutionizing commerce and eliminating inefficiencies seems prevalent across media. A cursory survey of recent literature[xi]touts a number of advantages, theories and claims:

- Elimination of Intermediaries (Financial, Legal, Professional Services, Humans)
- Reduction of Paperwork
- Cost Reduction
- Security & Speed
- Distributed Verification and Accuracy (Traceable & Scaleable)

Equally prevalent on is the discussion of fears and doubts. Concerns include:

- Questionable Legal Status
- Obfuscated Structure to the Parties (Known Only to Coders)
- Difficult Implementation
- Hackable
- Inflexible

Legal Basis for Electronic Contracts

The electronic Signatures in Global and National Commerce Act (the "E-Sign Act")[xii] and the Uniform Electronic Transactions Act (the "UETA") [xiii] which has been enacted 47 states[xiv] permit international electronic commerce, and not just smart contracts or blockchain in particular. The measures form the basis for the enforceability of smart contracts enabled by AI. As the Federal Trade Commission ("FTC") succinctly stated:[xv]

> [The E-Sign Act] signed into law on June 30, 2000, provides a general rule of validity for electronic records and signatures for transactions in or affecting interstate or foreign commerce. The E-Sign Act allows the use of electronic re-

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> cords to satisfy any statute, regulation, or rule of law requiring that such information be provided in writing, if [a party] has affirmatively consent.

Moreover, Section 14 of the UETA permits automated transactions. Section 2(1) and (6) are relevant:

> (2) "Automated transaction" means a transaction conducted or performed, in whole or in part, by electronic means or electronic records, in which the acts or records of one or both parties are not reviewed by an individual in the ordinary course in forming a contract, performing under an existing contract, or fulfilling an obligation required by the transaction.
>
> (6) "Electronic agent" means a computer program or an electronic or other automated means used independently to initiate an action or respond to electronic records or performances in whole or in part, without review or action by an individual.

Also, Section 14 (1) and (2) describes the formation which can be thought of the meeting of the minds of the electronic agents:

> (1) A contract may be formed by the interaction of electronic agents of the parties, even if no individual was aware of or reviewed the electronic agents' actions or the resulting terms and agreements.
>
> (2) A contract may be formed by the interaction of an electronic agent and an individual, acting on the individual's own behalf or for another person, including by an interaction in which the individual performs actions that the individual is free to refuse to perform and which the individual knows or has reason to know will cause the electronic agent to complete the transaction or performance.

One open legal question related to using AI to enter into a smart contract is whether actual consent has been provided by a party when an AI uses dynamic and arguably unforeseen behavior to act on the party's behalf. To the authors' knowledge, no court has yet ruled on this issue.

Artificial Intelligence

"Artificial Intelligence" is defined by Meriam-Webster[xvi] as:

- a branch of computer science dealing with the simulation of intelligent
- behavior
- in computers the capability of a machine to imitate intelligent human behavior

First Known Use: 1955

AI range from rule-based systems such as expert systems designed to make decisions based on rules and input, to more adaptive systems, such as neural networks, knowledge graphs, and logic. One area important for smart contract is natural language processing ("NLP").

As discussed below, AI could be used with smart contracts in at least two aspects (a) to negotiate and agree to terms with a counter party on behalf of a party, and/or (b) to control the self-executing nature of smart contracts.

NLP techniques useful for smart contract construction include shallow semantic parsing, named entity recognition, co-reference resolution, and a host of other techniques. For example, shallow semantic parsing seeks to find chunks of text that fill certain roles such as:

Text:

[On the first of every month], [John Smith,

lessee] shall [pay] [lessor] [U.S. $1000.00] =>

Roles:

Due-Date: [On the first of every month]

Payor: [John Smith, lessee]

Payee: [lessor]

Fee: [U.S. $1000.00]

Name entity recognition could recognize "John Smith" and "Mr. Smith" as a proper noun or a specific entity. Co-reference resolution could bind the term "John Smith" to "lessee" so that reference to either term means the same thing.

AI techniques useful for automatic negotiations and smart contract control include expert systems, search, neural networks, and the Min-max algorithm. If adequate consent has been given by the parties, AI could use these algorithms to negotiate as an electronic agent on behalf of the parties.

Potential Application of AI with Smart Contracts

Currently, the authors are not aware of AI being used in smart contracts. The challenges for contractual language, and language interpretation in general is the multi-faceted interpretation of language. For example, the same words may have many senses, and AI must interpret the language appropriately. For example, the term "execute" is used often to refer to agreements, but means to come to an agreement, and not to kill. This is referred to as the words sense disambiguation task. NLP requires solving many other tasks. But generally, language that refers to finite and definable things, such as dates, and times, quantities such as monies or rates of changes of monies, such as consumer price index could be more easily converted into a smart contract.

For example, an AI may be programmed to negotiate terms for price and quality of certain goods using well known AI game playing algorithms, with parameters for certain gap filler terms such as ranges of price and range of quality that can be adjusted dynamically, and fixed inputs by users for the type of goods. The AI may use search, or even a supervised or unsupervised learning technique to mine the data for the best price to quality ratios over the next N months, and may trigger the purchase at an optimal time in the near future that maximizes some price to quality ratio. Moreover, the self-executing contract may vary delivery quality based on price changes negotiated by the AI.

Defining gap filler terms is not unusual in commercial agreements. For example, the Uniform Commercial Code 2, which has been adopted in 49 states, includes many gap filler terms such as § 2-305 (Open Price Term), § 2-306 (Output, Requirements and Exclusive Dealings); § 2-307 (Delivery in Single Lot or Several Lots); § 2-308 (Absence of Specified Place for Delivery); § 2-309 (Absence of Specific Time Provisions; Notice of Termination); and § 2-310 (Open Time for Payment or Running of Credit; Authority to Ship Under Reservation). The use of AI in smart contracts could be a natural extension of statutory gap fillers that may be more dynamic and specific to the parties' needs.

In Smart Contract Templates: Foundations, Design Landscape and Research Directions [xvii], *Clark, et. al* discuss an example of smart contract technology that combines the legal text, the parameters and the software code:

> [An AI Researcher] presents the Ricardian Contract triple of "prose, parameters and code." The legal prose is linked via parameters (name-value pairs) to the smart contract code that provides automation. For example, a software agent might have been developed that will be instantiated on a shared ledger and, once initiated, will proceed to undertake various transfers of value in accordance with the legal prose. The parameters are a succinct way to inform the code of the final operational details. The code in this case would be suitable for a specific platform but we can imagine in the future that multiple platforms could be targeted from a single contract.

This is only one example of how a smart contract may be constructed.[xviii] However, AI researchers, especially in the natural language processing ("NLP") area, have been making great strides in automatic contract analysis and automatic contract drafting.[xix] It is conceivable that AI could be used to create at least partially, the self-executing code and parameterization based on parsing a traditional "human" contract in order to generate the smart contract. Techniques useful for such processing could include shallow semantic processing, named entity recognition, word sense disambiguation, and the like.

For example, Agrello describes their "belief-desire-intention" model and smart contract construction tools, which uses a form of shallow semantic parser to create decision rules that could be executed by the smart contract. [xx] Based on parsing the text, the AI system could create a rule that is triggered if a lessee pays a lessor the appropriate rent on or before the due date.

Enforceability, Disputes and Arbitration

Much has been written about enforceability of smart contracts. Of interest here is when smart contracts technologies make more adaptive decisions using AI or enter into agreements using more adaptive behaviors such as automatic negotiations of gap fillers, which may not have been anticipated by the user or the programmer of the smart contracts. To some extent, the UTEA contemplates such dynamic behavior. The commentators of the UTEA note:

> An automated transaction is a transaction performed or conducted by electronic means in which machines are used without human intervention to form contracts and perform obligations under existing contracts. Such broad coverage is necessary because of the diversity of transactions to which this Act may apply.

As a practice, to the extent a jurisdiction or court may find that certain terms may not as a matter of law be capable of agreement via an electronic agent or AI which adapts to circumstances and does not act using exact inputs, it is advisable to include a severability clause, and a binding dispute resolution provision between the parties before arbitrators who are qualified to understand AI technology and smart contracts. Courts have routinely upheld severability clauses, and this is known legal territory.[xxi] The Federal Arbitration Act and the New York convention is well known to permit international enforcement, and these legal tools should be used in smart contracts enabled by AI.[xxii]

To prevent a user from arguing that there is no proper offer or acceptance because terms were either not agreed to by the user themselves or were indefinite (e.g., via time, quantity or price), a smart contract platform should disclose how an AI powered smart contract may behave and warn that the AI's behavior may be unexpected, because, for example, it may balance price and quality for example, and the quality of a purchased item may vary. A dispute resolution agree-

ment such as an arbitration clause (with potentially a class action waiver) may be advisable in this situation as well to avoid liability for the smart contract platform provider.

Conclusion

To prepare ourselves for the adoption of smart contracts in general and AI empowered smart contracts in particular, the smart lawyer must keep abreast of the current technology and understand its limitations. Clients may ask the lawyer to work with the clients' programmers to translate a smart contract into code that may very well execute on the blockchain for a long time to come. These pros and cons for the use of smart contracts and AI on the blockchain present legal challenges and opportunities, and with proper implementation and regulation, these arrangements could revolutionize business and the law.

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[xiii]National Conference of Commissioners on Uniform State Laws, Uniform Electronic Transactions Act (UETA, 1999)

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NYDFS CYBERSECURITY REGULATIONS: ONE YEAR LATER

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Background

In September 2016, New York Governor Andrew Cuomo and Superintendent of the New York State Department of Financial Services (the "DFS") Maria Vullo announced the proposal of cybersecurity regulations described as "groundbreaking" due to their specific applicability to banks, insurance companies, brokers and agents, and other financial services firms and professionals. The regulations were finalized in March 2017 and codified under Part 500 of the DFS's regulations ("Part 500").[1] Roughly one