Effect Network:
Decentralized Network for Artificial Intelligence

REV-1.0

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Abstract

The Artificial Intelligence (AI) market is growing at a remarkable rate but has become more inaccessible than ever. The requirement for large annotated datasets and a complex technical infrastructure has driven AI development behind the closed doors of corporations. This paper introduces an open, decentralized network called *Effect.AI*, that provides services in the AI market. The network replaces several existing services and requires no fees, has a low barrier of entry and provides fast growth of the industry. This is accomplished by three platforms that run on the NEO blockchain and are fueled by a network token called EFX. The first platform is a marketplace for tasks that require human intelligence. It allows anyone in the world to perform tasks for a fair payment and gives businesses access to a large workforce of human intelligence. The second platform is a decentralized registry of AI services described by a rich ontology. On this platform any algorithm can be accessed as a service in a unified manner and has a convenient way to receive payment. The last platform provides a decentralized, distributed computational platform that can run popular deep learning frameworks. The effect of this network will define the future relationship between humans and AI.

Contents

Whether we are based on carbon or on silicon makes no fundamental difference; we should each be treated with appropriate respect.

Arthur C. Clarke

1 Introduction

Artificial Intelligence (AI) is progressing rapidly and has already caused many different effects. We see AI applications everywhere we look; from phones to autonomous vehicles to biotechnology, AI has become ubiquitous. AI is often considered the key component of the Fourth Industrial Revolution [1]. Like the revolutions that preceded it, the Fourth Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world. However, the revolution could yield greater inequality as well, particularly in its potential to disrupt labor markets as automation substitutes labor across the entire economy [1]. Consider, for example, when entire workforces were laid off when pinhead factories started incorporating machines in their fabrication process. A similar, though far larger threat looms due to new advances in AI development. Bill Gates had the idea to tax labor performed by AI-algorithms, to compensate for the loss of jobs in many sectors[1]. This idea seemed science fiction at the time, but the concept can be realized on the *Effect Network*, a decentralized network for AI. *Effect.AI* brings AI-algorithms to an open and proven decentralized platform, powered by the blockchain and accessible to all.

1.A Blockchain

A *blockchain* is a decentralized data store that can contain arbitrary logic and processes, without the need for a trusted central party. Blockchain was first proposed in the Bitcoin whitepaper by Satoshi Nakamoto, 2009 [2]. Since then the

[1] https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/

technology has been applied in many areas, and has had a disruptive influence in the markets of banking, insurance, real-estate, to name a few. Decentralized applications have some unique properties like transparency and a fixed history. We propose a protocol that decentralizes the global market in AI; which lowers the barrier for entry, stimulates market growth and greatly reduces usage cost.

NEO NEO [3] is (i) the use of blockchain technology and digital identity to digitize assets, and (ii) the use of smart contracts for digital assets to be self–managed. This establihes, what is called, a *Smart Economy* with a distributed network[2]. Hence, it's a smart contracts ecosystem, similar to Ethereum [4].

NEP5 tokens are tokens that are managed by smart contracts on the NEO blockchain. Most existing NEO projects use a NEP5 token (e.g. *RedPulse*[3], *Qlink*[4], and *DeepBrain Chain*[5]). NEP5 describes the protocol that these tokens conform to, as the *Effect.AI* EFX token does as well.

1.B Artificial Intelligence

AI is intelligence displayed by machines, in contrast with the Natural Intelligence (NI) displayed by humans and other animals. In computer science AI is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of success at some goal.

In the past five years there has been a rapid growth in the number of practical AI applications. Smart services like self-driving cars, face and voice recognition in mobile phones, and image translation are getting a central place in every-day life. The increase in AI applications can be explained by the advances in Machine Learning (ML), Computer Vision (CV), and Natural Language Processing (NLP) research, as well as the ready availability of cloud computing. This has resulted in large adoption by the industry and the birth of a billion-dollar-economy around smart applications. While academic achievements are

[2] http://docs.neo.org/en-us/index.html
[3] https://coin.red-pulse.com/
[4] https://www.qlink.mobi/
[5] https://www.deepbrainchain.org/

available to the public most intelligent algorithms are developed behind the closed doors of large corporations. We propose a private, decentralized ecosystem called the *Effect.AI Network* (*Effect Network*). The network is designed to develop in the phases shown in fig. 1, and operates fully on smart contracts deployed on a Turing-complete blockchain.

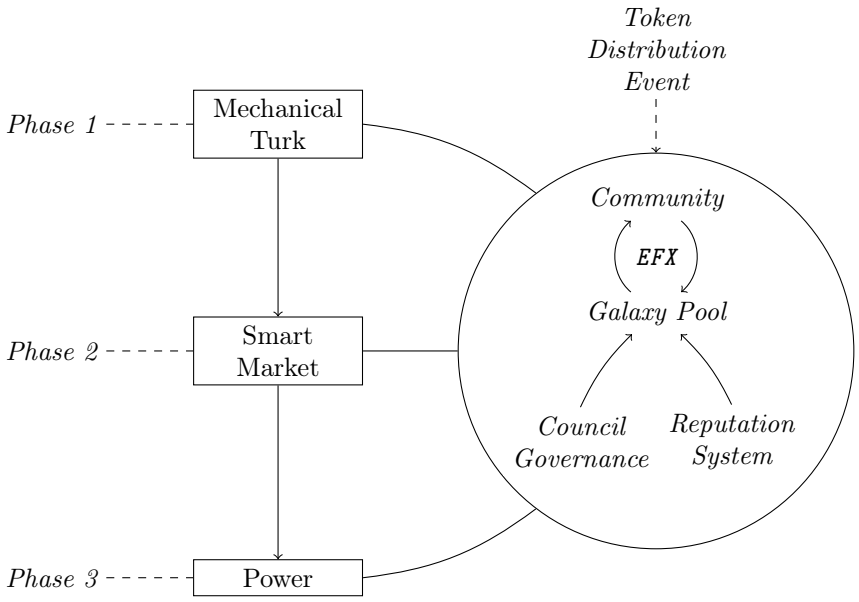

Figure 1: Development roadmap for the *Effect Network*

1.C Problem Statement

Despite the advantages AI brings there are a number of problems that have to be dealt with, especially regarding the research and development of AI technology. These problems can broadly be categorized into three areas that currently make AI research and development difficult to perform.

Data processing The first problem is that of *data processing*. Intelligent applications perform tasks that traditionally require human feedback. Such tasks involve processing unstructured data and finding patterns that can provide useful output. These applications are trained on large data sets with annotations.

Obtaining an annotated data set is non-trivial and requires a lot of time and resources.

Diverging Tasks The second problem that currently makes AI hard to practition is that of *diverging tasks*. An obstacle when developing a complex algorithm is the need to interact with parts of the world outside the current domain. For example: a self-driving car learning to steer will also need to identify road signs around the world. This situation can best be treated as a knowledge system where the classification of the sign is done by an external application. This quickly increases the complexity of an application.

Computational Costs The last main problem is the *computational cost* of AI algorithms. Developing and training AI systems is in most cases a computational intensive and thus expensive task. It requires a technical infrastructure capable of processing large amounts of data, doing batched processing on Graphics Processing Units (GPUs) and coordinating the results.

1.D Solution *Effect.AI*

A decentralized ledger like the blockchain provides a direct link between supply and demand which can greatly mitigate these problems. The transparency that blockchain offers will boost discoverability on the network, resulting in a high degree of collaboration and data sharing between agents. It also increases knowledge diversity and makes AI more affordable by sharing costs. Around this vision the *Effect Network* is designed. Like other decentralized applications, *Effect.AI* directly connects supply and demand without the need for an intermediary party. To be more specific, the *Effect Network* will establish the following:

1. **Accessibility.** By directly linking supply and demand through our microtasking platform *Effect.AI* Mechanical Turk (EMT) will make training AI algorithms easier, faster and cheaper (section 3). This will enable users

who do not have access to a large dataset or a big network to train their AI algorithm.

2. **Accuracy.** The *Effect.AI* Smart Market (ESM) is an exchange with a rich ontology of specialist AI applications. Individual applications are able to find each other to buy or sell information, as specified in section 4. Through this exchange, users can use data sets with significantly higher complexities to train their AI algorithms.

3. **Performance.** Users can enrich their existing datasets by purchasing services from algorithms on the ESM (section 4), or they can setup a new datasets by creating micro-tasks on the EMT platform (section 3). By enabling users to build datasets quickly and accurately they can immediately use these datasets to train AI algorithms.

4. **Interoperability.** By putting the AI algorithms on the blockchain and creating a communication standard to which these AI algorithms have to comply to, we can truly decentralize AI and achieve interoperability between individual AIs (section 5). The combination of multiple AI algorithms will result in powerful capabilities and emergent intelligence that no single AI algorithm can achieve on its own.

The network will be deployed in consecutive phases, allowing adaption and development of the network to grow together. The phases cover independent market sections but are interconnected in our network model and are all fueled by the same token; the `EFX` token.

The rest of the *Effect.AI* whitepaper is structured as follows. The *Effect Network* will be outlined in section 2. Hereafter, section 3, section 4, and section 5 will detail the three different phases for the development of the *Effect Network*, in chronological order. The whitepaper will be concluded in section 6.

I alone cannot change the world, but I can cast a stone across the waters to create many ripples..

Mother Teresa

2 The community driven Effect Network

The *Effect Network* can be deployed and used as a decentralized application as-is. However, in order for the network to grow and be sustainable, we believe there has to be a form of governance. Participants should have incentive to use the `EFX` token for the purpose of AI tasks. Investors looking for quick monetary gain should be discouraged and pump-and-dump schemes should be avoided in order for the network to grow and slowly take market value from the existing centralized services.

The *Effect.AI* Galaxy Pool (EGP) will be outlined in section 2.A. Thereafter, section 2.B will explain the reputation mechanism in the network. The *Effect.AI* Galaxy Allowance (EGA) will be outlined in section 2.C, section 2.D details the governance system, section 2.E is dedicated to the improvement proposal system, and section 2.F explains the council formation. This Section will finish with blockchain implementation specifics on the `NEO` and `GAS` platform in section 2.G.

2.A `EFX` tokens and the Effect Galaxy Pool

It is important to maintain liquidity in `EFX` tokens, especially during the early days when there is no listing on exchanges. Ideally the following actions should always be possible:

1. Workers are able to sell their `EFX` rewards for native tokens
2. Requesters and network users should be able to buy `EFX`

For a new token on the market this kind of liquidity can be hard to achieve and can be hurt by speculative trading. The *Effect.AI Network* (*Effect Network*)

will maintain a central pool of tokens to provide liquidity, encourage adoption and stabilize network fees. This pool is called the *Effect.AI* Galaxy Pool (EGP) and consists of a mix of EFX and native tokens. Several rules will drive the EGP towards an equilibrium. These rules can later be refined by means of governance as is discussed in section 2.D.

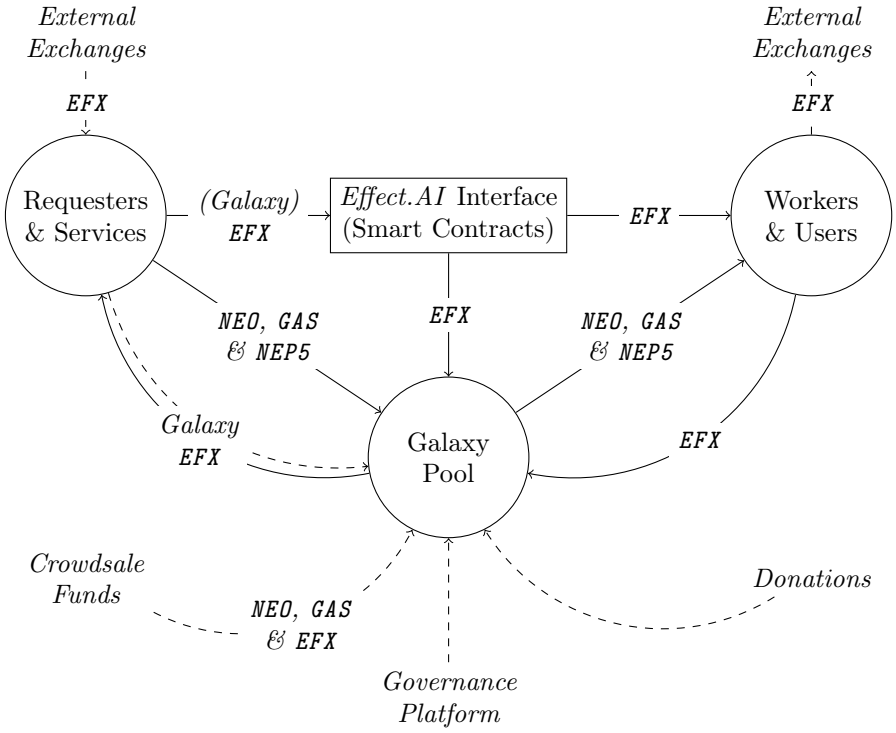

Figure 2: Diagram of the *Governance Model* and construction of the *Effect.AI* Galaxy Pool

The EGP ensures stable exchange rates for users of the network at all times. The pool is not suitable for day traders, as only *Galaxy*-EFX tokens (*G*-EFX) can be bought. Any *G*-EFX bought from the EGP can not be sold back to the EGP. A *G*-EFX is *washed* (converted to a regular EFX token) by spending it through an *Effect.AI* Service Contract (ESC). These are the smart contracts that processs the transactions of tasks and the service registry. This protects the EGP from external manipulation and keeps exchange rates stable for all

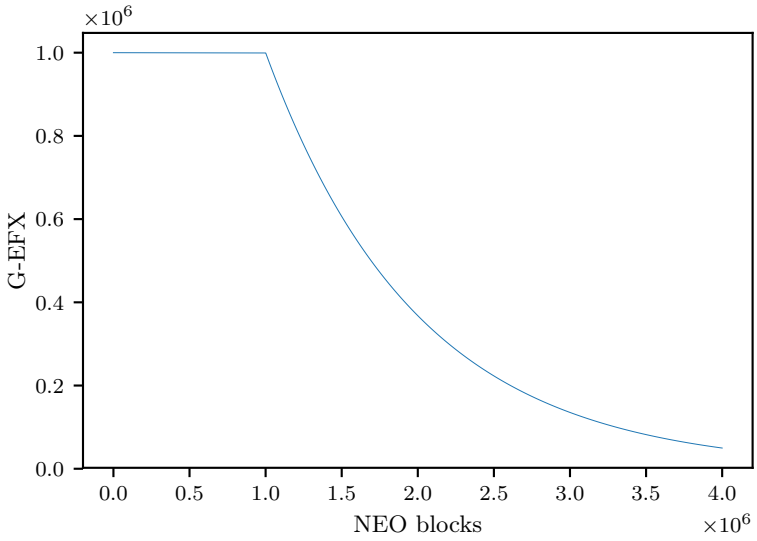

Figure 3: Total amount of *G*-EFX for 4×10^6 blocks in the NEO blockchain

agents in the network.

To assure *Requesters* will not have an overflow *G*-EFX will gradually expire and flow back to the EGP over time. eq. (1) shows how *G*-EFX flows back every α blocks in the *blockchain*.

$$G\text{-EFX}' = \begin{cases} G\text{-EFX}, & \Delta\big(\beta_{current}, \beta_{last.}\big) < \alpha \\ G\text{-EFX} - \gamma \cdot \sum_{i}^{\Delta} \big[G\text{-EFX} \cdot (1-\gamma)^i\big], & \text{otherwise} \end{cases} \tag{1}$$

Where *G*-EFX′ is the new wallets' total from the original transaction, β are blocks in the NEO blockchain, γ is the backflow factor defined by the *Effect Council*, and α is the number of blocks that have to go past for the function to activate. $\Delta\big(\beta_{current}, \beta_{last.}\big)$, or short Δ, denotes the number of blocks since the last time the *G*-EFX was decreased.

This ensures, for a *Requesters*, there is seamless payment for the ESC with native tokens, such as NEO, GAS, and other NEP5 tokens.

Other measures that will be undertaken in order to maintain a healthy liquidity in the *Effect Network* to keep the EGP stable, especially in the first phase of the development, are the implementation of beneficial exchange rates between `EFX` tokens and the native tokens `NEO`, `GAS`, and `NEP5` tokens. This means that *Requesters* will have to pay less native tokens to use *Effect Services*, and that *Workers* will recieve more native tokens in exchange for their received `EFX` tokens.

In the future, when cross-chain trading techniques are more common in blockchain, other tokens (e.g. `BTC` and `ETH`) can be added to the EGP.

2.B Effect Reputation Score

Users in the *Effect Network* are rewarded for the amount of effort and work they do. This could allow malevolent users to gain wealth by submitting large quantities of work with poor quality [5]. To avoid users submit work with bad quality, the network will appraise users by their quality of work. Users that put in good effort will get a higher *Effect.AI* Reputation Score (ERS), and users that put in poor effort will get a lower ERS. This score will gradually expire over time. Workers with a higher ERS will be able to apply for higher rewarding tasks than workers with a lower score. Furthermore, workers with higher, rather than lower, ERS will have to pay a lower fee over their recieved `EFX` tokens to the EGP.

ERS is credited to users ad-hoc when they are rated for good work. There are two ways this can happen:

1. The task owner can add Ground Truth / Known Answer ratings of examples. If a worker rates an example similar to the ground-truth provide by the task owner, they are rewarded ERS, else they lose this score. Ground-Truth examples are stored encrypted on the blockchain and the decryption key is shared by the requester after the task has expired. Thus the rating takes place after task expiration time.

2. Workers that deliver similar work and performance on the same Human

Intelligence Tasks (HIT) (section 3) are credited with ERS. This is done periodically and at random. *Workers* that consequently give deviant feedback are subtracted ERS.

The ERS function is represented in eq. (2). Let $F(t)$ be the degradation function of positive scores, and negative scores, over time. Let $\mathbf{P}$ be a set of positive score-time entries p, and $\mathbf{N}$ be a set of negative score-time entries n.

$$\text{ERS} = \sum_{i}^{N_{\mathbf{P}}} \Big[p_{i,score} \times F(p_{i,time}) \Big] - \omega \Bigg(\sum_{i}^{N_{\mathbf{N}}} \Big[n_{i,score} \times F(n_{i,time}) \Big] \Bigg) \quad (2)$$

Where $N_{\mathbf{P}}$ is the total number of positive evaluations, and $N_{\mathbf{N}}$ is the total number of negative evaluations. ω is the weight factor for negative scores that is governed (section 2.D) to maintain a healthy and effective workforce in *Effect.AI*. As of now, we found a linear degradation in $F(t)$, and a weight $\omega = 5$ assures best results in our simulations.

2.C Galaxy Allowance

An other use case of the Galaxy Pool is to provide liquidity on the supply side of `EFX`. Earlier we saw how "consumers" of services can purchase *G*-`EFX` which is only spendable to Effect Service Contracts. In a similar way "producers" of services are able to sell `EFX` to the EGP at fixed rates. As the rates can be profitable compared to market, this exchange must be restricted to contributers of the network. To accomplish this we introduce Galaxy Allowance.

Any person or algorithm on the network that earns `EFX` tokens from an ESC, gets an equal amount of *Effect.AI* Galaxy Allowance (EGA). EGA can be used to sell an amount of `EFX` tokens to the EGP at a very profitable rate. This rate is maintained by the *Effect.AI* Council (section 2.F) through voting. This way *Workers* and algorithms are not dependent on market fluctuation of `EFX` tokens as they can always sell their earning at stable rates. The general *Effect.AI* exchange protocol is reflected in eq. (3), eq. (4), and eq. (5). The exchange

rates $c_{\texttt{NEO}}$, $c_{\texttt{GAS}}$, and $c_{\texttt{NEP5}}$ remain constant untill the *Effect.AI* Council changes them.

$$\texttt{NEO} = c_{\texttt{NEO}} \times \texttt{EFX} \tag{3}$$

$$\texttt{GAS} = c_{\texttt{GAS}} \times \texttt{EFX} \tag{4}$$

$$\texttt{NEP5} = c_{\texttt{NEP5}} \times \texttt{EFX} \tag{5}$$

2.D Governance

The blockchain is immutable by nature, yet the Effect Network has to be able to continuously adapt to market and research developments. This means the network needs a mechanism to apply changes to its components when necessary. There are two types of changes that can be applied. Firstly, there are the variables defined in Smart Contracts (SCs) that can change over time. Examples of SCs' variables that can change over time are the exchange rates in the EGP and the fees over service transactions. Secondly, the smart contracts themselves need to be changeable with sufficient agreement: introducing new SCs - like new task types - and amending existing contracts will be necessary in the future. As the *Effect Network* is decentralized there can not be a single person or organization authoring these changes. To fix this, the network has a governance system that allows prominent people in the community to propose and vote for improvements as explained in section 2.E. Right to vote is at first acquired by selected individuals as discussed in section 2.F.

2.E Improvement Proposals

Both smart contracts and service variable adjustments should be submitted to an improvement proposal system. Each proposal contains logic for adjusting parts of the ecosystem. A proposal is only executed if a majority of the council members voted in favor of it within a time limit.

2.F Effect Council

The *Effect.AI* Council (EC) is a group of individuals that are allowed to cast a vote on improvement proposals. This council is dynamic in size; one can leave the group at any time and new members can join if they are approved by the majority. The council members are responsible to continuously apply changes to the network so it can adapt to the dynamic market.

2.G Implementation

This Section contains examples of how the platform would function when built on the NEO blockchain. NEO is a blockchain that uses Delegate Byzantine Fault Tolerance (dBFT) consensus and features Turing-complete SCs. It also has features for user identification and file storage that make it a very suitable host for the *Effect Network*.

Galaxy Pool: NEO and GAS In NEO there are two native tokens: NEO and GAS. The GAS is a utility token used for paying network fees. These are fees associated with deploying and executing smart contracts. NEO acts as a share in the platform; holding NEO gives a payout in GAS from network usage. In this setup, the EGP should hold a combination of EFX, NEO and GAS to function correctly. The NEO is used to payout workers at a stable exchange rate and to increase the GAS stake by collecting dividend. As NEO is indivisible the rate should be defined in $\frac{\text{EFX}}{\text{NEO}}$. The GAS is used to pay any network fees to users of the network, so workers will not have to go to an exchange to use the platform. The GAS is also used to deploy new smart contracts and amend existing smart contracts. This is crucial as the *Effect Network* will be developing all the time.

There are no great limits to growth because there are no limits of human intelligence, imagination, and wonder.

Ronald Reagan

3 Phase 1: *Effect.AI* Mechanical Turk

The *Effect.AI* Mechanical Turk (EMT) platform is a decentralized, peer to peer marketplace for tasks that require human intelligence. It provides similar features as centralized services like Amazon Mechanical Turk[6], Fiverr[7], Crowdsource[8] and Guru.com[9]. It is a crowdsourcing technology that enables *Requesters* (section 3.A) to submit tasks that can be completed by human agents in exchange for compensation. *Workers* (section 3.B) can accept tasks from *Requesters* at any time, anywhere and from any device. The tasks are called Human Intelligence Tasks (HIT). The providers of the HITs are called *Requesters*. When a *Worker* completes a HIT, they are paid with cryptographic `EFX` tokens.

3.A Requesters

Requesters can put tasks (see section 3.C) on the EMT platform to be completed by workers. The requesters can decide how many `EFX` the workers will get for each completed task. The requesters can retrieve the results from the EMT platform and use these results to, for example: train their Artificial Intelligence (AI) algorithm. EMT gives requesters access to an on-demand, scalable and distributed workforce.

3.B Workers

Workers can complete the tasks from the requesters in exchange for the `EFX` tokens tied to these HITs (see section 3.C).

[6] https://www.mturk.com/
[7] https://www.fiverr.com/
[8] https://www.crowdsource.com/
[9] https://www.guru.com/

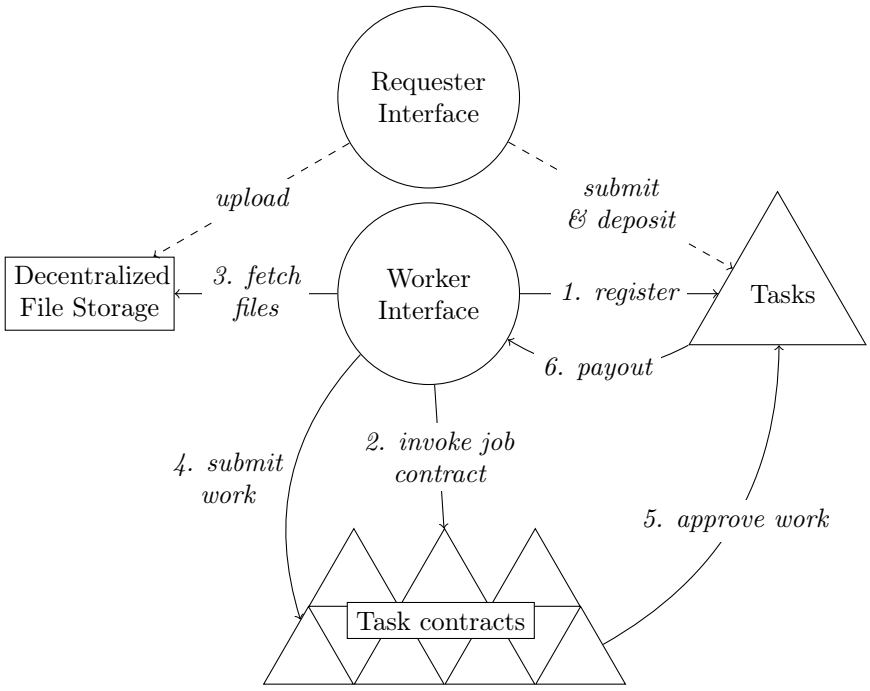

Figure 4: Process of submitting tasks on the *Effect Mechanical Turk*

3.C Tasks

A HIT task represent a piece of work that has been submitted by a *Requester*, and can be accepted by *Workers* that match its requirements. Each task points to a data set that can contain any amount of media assets. The contract ID of the task will validate the format of the data. Extracting and presenting examples from the data set is done by the user interface. A task has at least the properties shown in table 1.

The structure and required feedback for a task is defined by the contract ID and the blueprint. Each type op task requires a smart contract to handle interaction. *Effect.AI* maintains a database of deployed smart contracts to make it easy for requesters and workers to interact with the network. Adding smart contracts to the network is handled through governance (section 2.D). Affiliate programs will cover costs of deploying new contract types.

Property	Description
Data set	URL
Description	description of the task
Contract ID	smart contract that will handle task
Blueprint	data for the contract
Required ERS	require trusted users
Reward	rewarded `EFX` upon completion
Num. ratings	number of ratings per user
Rating timeout	timeout on performing a rating
Expiration	block ID after which task expires
Sequence ID	for sequencing examples (optional)
Data credentials	to unlock private data sets

Table 1: Properties of a HIT

3.D Data sets

Data sets are often large and consist of various types of media. A blockchain is not a suitable database for storing this kind of information. Other decentralized storage options, like BitTorrent[10] and IPFS[11], are specialized in these types of assets. For this reason, the network will use a similar hash-based distributed file storage, where each media asset can be referred to by a single hash.

Note that the feedback on a *task* can also involve storing media assets, for example in tasks like image segmentation. In this case the ratings asset will be stored on the distributed storage, and a hash and checksum of the rating are stored on the blockchain.

Requesters will also be able to supply data sets through traditional channels, like Amazon S3[12], Google Cloud Storage[13], or File Transfer Protocol (FTP)[14].

3.E Privacy

The blockchain is decentralized and open by nature. These properties are not always desirable, for example when privacy is concerned. There are several

[10] http://www.bittorrent.com/
[11] https://ipfs.io/
[12] https://aws.amazon.com/s3/
[13] https://cloud.google.com/storage/
[14] https://nl.wikipedia.org/wiki/File_Transfer_Protocol/

measures that must be taken to make sure the *Effect Network* can be used for sensitive information. The network can provide privacy for the following cases:

Data sets Requesters can provide their data set in encrypted form. Only selected users will be able to decrypt or access the data. This is determined by network smart contracts using Public Key Encryption, ensuring only selected users can decrypt the data set credentials.

User ratings Ratings of tasks performed by workers are stored on the blockchain using Public Key Encryption. The public key of the owner is used to sign the ratings, so only the owner of the task can view the ratings.

Tasks that involve privacy features will be more computationally expensive, thus will also have a higher network fee.

I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted.

Alan Turing

4 Phase 2: *Effect.AI* Smart Market

The *Effect.AI* Smart Market (ESM) is a decentralized marketplace where AI algorithms can exchange their services. An application owner can register on the exchange by specifying a public endpoint of his or her application, following our data interchange format and specifying a usage fee for consumers. This application can now be invoked through smart contracts on the blockchain. The caller of the contract will have to transfer the required funds to the owner of the contract to get an authorization token that allows him or her to interact with the application.

The exchange protocol can be built directly onto the *Effect.AI* interface setup proposed in section 2, where the agents receiving `EFX` tokens are the ones supplying AI algorithms, and the agents providing `EFX` tokens for these services are the *Requesters*. The *Effect.AI* Galaxy Pool (EGP) is merely used in the background to assure liquidity. The EGP enables payments for these services with native tokens, as well as `EFX` tokens. At this point Smart Contracts (SCs) will ensure and improve availabilty of the services that are requested and/or provided by agents in the network.

Two important pillars in the ESM are the application registry and the endpoints. The following subsections will describe the application registry (section 4.A) and enpoints (section 4.B) in more detail.

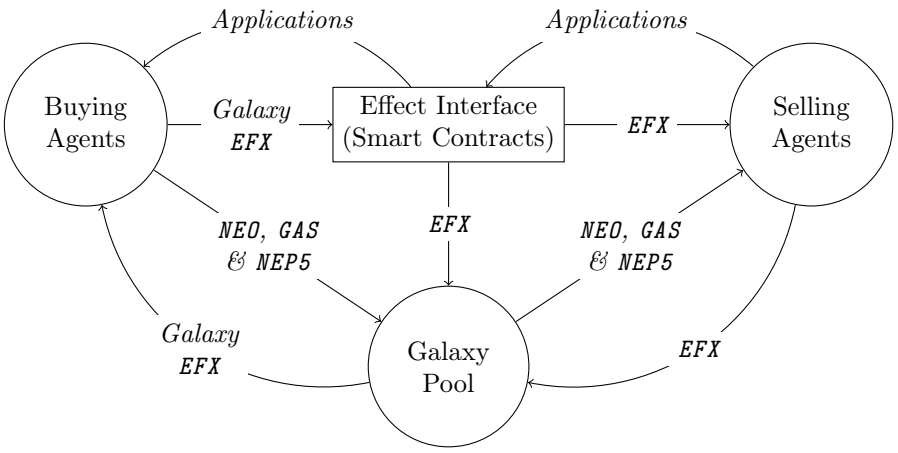

Figure 5: Diagram of the *Effect Smart Market*

4.A Application registry

The network will maintain a registry of available applications. This registry will be enriched with a semantic ontology that describes the application, as well as a technical schema of its inputs and outputs.

Thanks to the application registry, algorithms are able to explore possible collaborations over the *blockchain*. It also encourages standardization of data exchange formats, as interoperability with other applications means more interactions, providing an obvious financial incentive.

4.B Endpoints

Application endpoints on the ESM communicate over the HTTP protocol. Data is exchanged in JSON format and should strongly confirm the defined RDF schema.

Requests signed with the private key of the buyer will be accepted by the endpoint. Issuing authorization tokens and checking their validity can be done by public APIs that hold a partial index of the blockchain. They could request small fees for providing this service.

Alone we can do so little; together we can do so much.

Helen Keller

5 Phase 3: *Effect.AI* Power

Phase 1 and 2 of the *Effect Network* decentralized the data gathering and usage of AI algorithms. Up to this point the algorithms themselves still run on centralized servers. In the final phase of the network the actual computation will be distributed so that the algorithms run globally without a single point of failure. To achieve this we use the fact that most machine learning algorithms have rigid structure and operate on sets of weights. These types of algorithms are relatively easy to distribute. The *Effect Network* decentralized compute engine is based on popular Deep Learning (DL) frameworks like Caffe[15], MXNet[16], and TensorFlow[17], where the network structure can be defined as a declarative graph and weights are stored as matrices of real numbers. These matrices can be distributed over a decentralized file system and be processed at different compute nodes on the network.

[15] http://caffe.berkeleyvision.org/
[16] https://mxnet.apache.org/
[17] https://www.tensorflow.org/

Control is as much an effect as a cause, and the idea that control is something you exert is a real handicap to progress

Steve Grand

6 Conclusion

Having an open, accessible and affordable platform for intelligent algorithms to operate and develop will be a key component in the coming century. Artificial Intelligence (AI) and decentralization are a natural match and should be enforced more in the future. The vision and development roadmap of the *Effect.AI Network* (*Effect Network*) is to create an accessable and decentralized AI market.

Community The *Effect Network* is fueled by `EFX` tokens that allow for fair, decentralized and peer-to-peer exchange for everything related to AI. `EFX` tokens are `NEP5` conform and operate directly within the `NEO` smart economy blockchain.

Galaxy Pool One of the most unique facets of *Effect.AI* is the *Effect.AI* Galaxy Pool (EGP). The EGP is a governed exchange system and pool. The EGP is filled with both native `NEO` and `GAS`, as wel as, `EFX` and other `NEP5` tokens. This setup assures stable exchange rates. Furthermore, the EGP construction will allow to increase liquidity by providing, for example, beneficial exchange in the first phase of the network.

Prospects Besides a strong community driven platform and token exchange Galaxy Pool, the *Effect Network* will develop three different AI service markets, in consequtive phases. The first phase is called *Effect.AI* Mechanical Turk (EMT) and is similar to Amazon's Mechanical Turk data labeling platform. *Effect.AI* will effectively push the mechanical turk service on the blockchain using *Effect.AI* Service Contract (ESC), the smart contracts in the *Effect Network*. The second phase, *Effect.AI* Smart Market (ESM), builds upon the first phases

by expanding the service market, not only for data, but with algorithms as well. The ESM allows agents in the *Effect Network* to share, compare, and exchange AI algorithms. The third, and last, phase is called *Effect.AI* Power (EP) and allows for computation sharing completely in the *Effect Network*. EP completes the *Effect Network*. The effect of this network will define the future relationship between humans and AI.

List of Abbreviations

Effect Network	*Effect.AI Network*. 5–8, 11, 13, 14, 18, 21–23
G-EFX	*Galaxy*-EFX tokens. 9, 10, 12
AI	Artificial Intelligence. 1, 3–8, 15, 19, 21–23
CV	Computer Vision. 4
dBFT	Delegate Byzantine Fault Tolerance. 14
DL	Deep Learning. 21
EC	*Effect.AI* Council. 14
EGA	*Effect.AI* Galaxy Allowance. 8, 12
EGP	*Effect.AI* Galaxy Pool. 8–14, 19, 22
EMT	*Effect.AI* Mechanical Turk. 6, 7, 15, 22
EP	*Effect.AI* Power. 23
ERS	*Effect.AI* Reputation Score. 11, 12, 17
ESC	*Effect.AI* Service Contract. 9, 10, 12, 22
ESM	*Effect.AI* Smart Market. 7, 19, 20, 22, 23
FTP	File Transfer Protocol. 17
GPUs	Graphics Processing Units. 6
HIT	Human Intelligence Tasks. 11, 15–17
ML	Machine Learning. 4

NI Natural Intelligence. 4

NLP Natural Language Processing. 4

SCs Smart Contracts. 13, 14, 19

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