



Human AI

Protect and Monetize Personal Data for
Human-Centric Artificial Intelligence

- v1.0 -

HumanAI AG

www.HumanAI.co

2018

Abstract

Data is the most precious asset in the digital society. It has been widely leveraged to build predictive models thereby optimizing marketing campaigns, product recommendations, and service personalization. However, existing approaches of collecting personal data are far from acceptable. More important, users who generate and provide data receive no benefit although their data creates huge values.

We thus utilize human artificial intelligence, edge computing, and blockchain to create an autonomous, secure, and privacy-preserving system that protects personal data and meanwhile bringing benefits of artificial intelligence. Blockchain and smart contracts are crucial as they guarantee autonomous payment, access control, and data integrity.

Consequently, users will be empowered to unlock and monetize personal data but keeping it private and unseen throughout the whole process. They can tune trade-off between data privacy and service personalization on their own. On the other hand, businesses will be able to access additional data sources and only pay for insights and aggregated results. More important, we provide a solution to help businesses stay in compliance with forthcoming data protection laws and regulations.

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1. Problem Statement

Advances in computing power, communication protocols, and mobile technologies make it possible for the first time to collect and analyze massive amounts of data in real-time, which brings the capabilities in machine learning and artificial intelligence (AI) from research to business applications. Companies start to collect user behavioral data and build predictive models to optimize marketing campaigns, product recommendations, and service personalization. The global data broker market reached \$156B in 2015 and is expected to be around \$270B in 2020, not including values the exchanged data creates (Goodman, 2016; TMR, 2018). The success of Google and Facebook in adopting consumer data analytics encourages more companies to move in this direction. For companies, data monetization turns to be a major source of revenues (IDC, 2016).

Consequently, collecting user behavioral data becomes a critical promise but existing approaches of personal data collection are far from acceptable. Companies used to gather behavioral data such as smartphone logs or browser cookies without user consent. The situation is getting better due to privacy laws, but resulted solutions like long terms and conditions or limited functionalities force users to click the agree button to use corresponding services. Once users have agreed to share personal data, they lose control of it. Typically, they have no clue about what, where, and when behavioral data is collected, not to mention what companies will do with the data and how to prevent misuse of it. With more strict regulations e.g., the General Data Protection Regulation (GDPR) coming into force from 2018, businesses have to provide users with personal data in a free and machine-readable way. In addition, data is precious in the digital society, but users who generate it get no reward in the whole value chain, which further makes users reluctant to share data.

Sharing more personal data will eventually lead to more accurate predictive models thus providing users with better services, but in the meanwhile triggering stronger privacy concerns. Recent advances in AI drive people's fear of it. We believe that AI development should not be stopped due to such a fear because the technology itself can help us make our society better. On the other hand, as data is a prerequisite of AI, we should also control the availability of and access to data thus reducing potential misuse of AI.



2. Vision

Control and monetize personal data for human-centric artificial intelligence in a decentralized privacy-preserving system.

2.1. What Is Human-AI and Blockchain?

According to Prof. Alex “Sandy” Pentland, a Human-AI is something that “is not a machine, but rather a cyber culture that we can live in as Humans, with a human feel to it” (A. “Sandy” Pentland, 2017b). A Human-AI system combines humans with AI automation to extend the intelligence capabilities of both parts. In a Human-AI system, humans are able to interact with AI algorithms to understand what assumptions and decisions the algorithms are making on users’ behalf, for example, by changing an algorithmic parameter and inspecting the changes on the output. Compared to traditional AI systems, a Human-AI system will have improved user trust and automation adoption (Dietvorst, Simmons, & Massey, 2016; Lyons et al., 2016). Also, combining humans with AI will perform better than humans and AI working alone (A. “Sandy” Pentland, 2017a). Blockchain, on the other hand, is a distributed digital ledger that ensures transparent and incorruptible transactions in practice. It enables the coding of smart contracts that will execute automatically when a pre-defined state is reached. Blockchain and smart contracts make it possible to conduct micropayments and state transfers securely and automatically in a peer-to-peer network.

2.2. How Does Our System Support the Idea of Human-AI?

The goal of this project is to create a global Human-AI system where individual user data contributes to a global artificial intelligence. We support cyber culture by providing a suitable communication protocol that can securely and privately handle personal data while still keeping the possibility of running AI algorithms on top of it. Pentland speaks of a gigantic neural network that spans the world with each neuron being a person who tries to contribute to the intelligence of the whole network. Our



system combines human intelligence with artificial intelligence by giving users possibilities to tune parameters of the neural network (e.g., setting personal trade-off between privacy and service level), or to provide truthful feedbacks thereby making each neuron smarter. With each neuron becoming smarter, the overall system and our society will get smarter in return.

2.3. Why Are We Able to Create It?

Most of our team members have known each other for at least three years as we are/were Doctoral Researchers at ETH Zurich and University of St. Gallen. We work together for various research projects and start-up initiatives and come up with good team spirit, trust, and results. A central question we aim to answer is how disruptive technology on mobile devices can change behavior of humans. For instance, can a user form his/her personality in a positive way through mobile intervention? Can real-time feedback encourage water conservation? Is augmented reality suitable for the detection of Alzheimer's disease? User data is essential to answer these types of questions, but such data is often difficult to access even though they are technically feasible to collect. Users would often be willing to provide the data to get personalized products and services, but fear misuse or loss control of data, nor have an effective instrument to automate the data exchange or receive a compensation for sharing data. We thus aim to close the gap and open up user data on mobile devices for research and industry. Years of experience in AI, product development, blockchain, and business involvement enables us to build useful solutions from scratch and deal with uncertainties coming along the journey.



3. Our Solution

3.1. Value Proposition

Our proposed solution is a human-AI ecosystem that leverages blockchain to give users control of personal data thereby enabling humans to interact with AI algorithms to make AI more personalized, secure, and adoptable. With our solution, personal data collected on a user's devices is controlled centrally by the user and only encrypted and/or aggregated knowledge will be shared with data consumers. Users can decide the granularity of shared data, with whom to share, and whether the corresponding services they receive meet personal demands. They thus interact with AI algorithms to balance the tradeoff between privacy and personalization on their own. If users do not want to share the data anymore, they can close the data access and do not have to worry about data leakage in the future. Personal data is tokenized and monetized in the Human-AI system, consequently, users will receive rewards from the value their data creates.

New privacy regulations around the world such as the GDPR in Europe require companies to provide users with personal data free-of-charge and in a machine-readable form. The Human-AI system could be a solution for companies to deal with the new challenge. With users having access to personal data, it becomes for the first time possible to connect various data sources to create new services. Imagine a situation where data like location movement, shopping transactions, fitness sensors, available coupons, and social activities are inter-connectable. New services can analyze such data and give more personalized recommendations to help us live healthier and purchase smarter.

Furthermore, one key to successful AI mechanisms is to get truthful feedbacks. The Human-AI ecosystem helps companies get rid of third-party survey agencies and directly sample users for ground-truth. Some companies in the ecosystem might act as AI service providers that build AI models upon shared personal data and sampled ground-truth. They can easily scale up business by developing an AI model, deploying it to the cloud, and leveraging blockchain to conduct access control and autonomous payment. In addition, personal data in the system is designed to be highly structured. This will significantly reduce the efforts of data cleaning and makes it possible for model reuse, automation, and pipelining.



3.2. Personal Data and Use Cases

Mobile Personal Data

Mobile personal data refers to behavioral data that can be collected on smartphones, such as a snapshot of user-installed apps, GPS signals, app usage, sensor and activity logs, etc. Research has shown that AI models can be built on such data to precisely predict user demographics, personal interests, attention, personality traits, and life events. Based on the predicted values, mobile recommendation systems could be enabled and significantly improve business performance (please refer to our scientific publications for details).

An Example: Pokémon Go was the biggest mobile game in US history based on its daily active users in 2016. As a result, augmented reality (AR) games are becoming a front-runner of the gaming industry. However, the mobile gaming industry is highly segmented, thus targeting the right customer group becomes crucial. Our solution can help app publishers identify smartphone users who have already installed AR games to conduct target marketing. Furthermore, how a user spends his/her time on various apps can be derived from smartphone logs, which leads to knowledge about the user's attention on smartphones and how it changes over time. Understanding such attention will provide new opportunities of recommendation and cross-selling. We are in talks with a machine-learning and analytics company that focuses on mobile app data to work together and provide first-generation AI services in the Human-AI ecosystem.

Mobile App Data

Users spend hours with mobile apps every day. Data about their activities in each app is highly utilized by companies to build AI models. However, forthcoming privacy laws and regulations make it hard for companies to collect and monetize in-app user data. Users might have a chance to request their own data but existing processes are complicated and selling data is close to impossible. With our mobile Software Development Kit (SDK), companies will be able to support users in monetizing in-app data and then share profit.

An Example: The cryptocurrency market is growing rapidly and many investors use mobile apps like Coin Market Cap to track performance of investment. In-app personal data, such as each user's portfolio, can be shared on social media but not yet monetized. With our SDK, anyone can publish his/her portfolio and users who want



to follow top-performing investors will have access to the data after paying a fee to the data publisher.

User Feedback Data

In addition to smartphone usage and in-app data, another type of personal data that can be monetized is user feedback, such as answers to a questionnaire. This is a key to combine human intelligence with machine intelligence. Existing approaches rely on third-party agencies to collect user feedback, which is costly and hardly context-aware. Blockchain enables companies to get rid of agencies thus directly communicating with end users in the ecosystem. With the help of mobile personal data, we can deliver context-aware (i.e., location-based or event-triggered) questionnaires, e.g., collecting feedbacks on a new railway app from people who have installed the app and currently waiting for trains in railway stations.

An Example: An innovative healthcare company hypothesizes that a user's interaction with his/her smartphone well reflects the user's stress. The Human-AI framework can be utilized to gather data on how people use smartphones, but scientific rigor requires ground-truth to assess their stress levels. Our SDK facilitates this by providing an opportunity to send users questionnaires to sample their real-time stress levels. Data about user demographics can also be leveraged to focus on target groups. After receiving both behavioral features and stress levels, the company can develop algorithms to predict each smartphone user's stress and then apply corresponding treatment to improve his/her mental health. A cooperation with the Center for Digital Health Interventions in Switzerland is planned for 2018 Q3.

3.3. Open Algorithm

One of the core characteristic of our solution is that open algorithms are exchanged. The concept is called MIT Open Algorithms (OPAL) and was originally proposed by "MIT Trust::Data Consortium" (<https://www.trust.mit.edu/projects>). For details, please refer to the book of Hardjono, Shrier, and our advisor Pentland (2016). It follows the paradigms proposed at the World Economic Forum (WEF) in 2008 for the protection of human data (Dutta 2009), known as the "New Deal on Data". Colleagues at MIT are currently implementing an OPAL system. A first version will be released in 2018 Q1. We have been invited to integrate core components of the OPAL system into our solution for mobile devices.



The OPAL system works as follows: Publicly verifiable algorithms run directly on a user's device (so called "Edge Computing"), which enables calculation to be performed on sensitive raw data with the data staying on device. In simple terms, code instead of data is shipped. Data consumers are thus enabled to cast insight generation into code and send it to users. Raw personal data remains on the user's device and only aggregated results or derived knowledge is shared with data consumers. Security and privacy becomes more manageable in this paradigm because each user controls his/her own data storage and monitors the privacy entropy of released algorithm outputs. As part of access control and policy management, each user can tune-up/down the granularity of shared data. Consequently, resulted services will become more/less personalized. As shown in Figure 1 on a high-level, open algorithm will perform the following tasks on a user's mobile device:

- Collect or aggregate user data (code is a data query)
- Display a survey within an app (code describes the survey in markup language)
- Apply an AI model to user data (code is an AI model)
- Send results back to data consumers
- Display results (real-time user feedback)

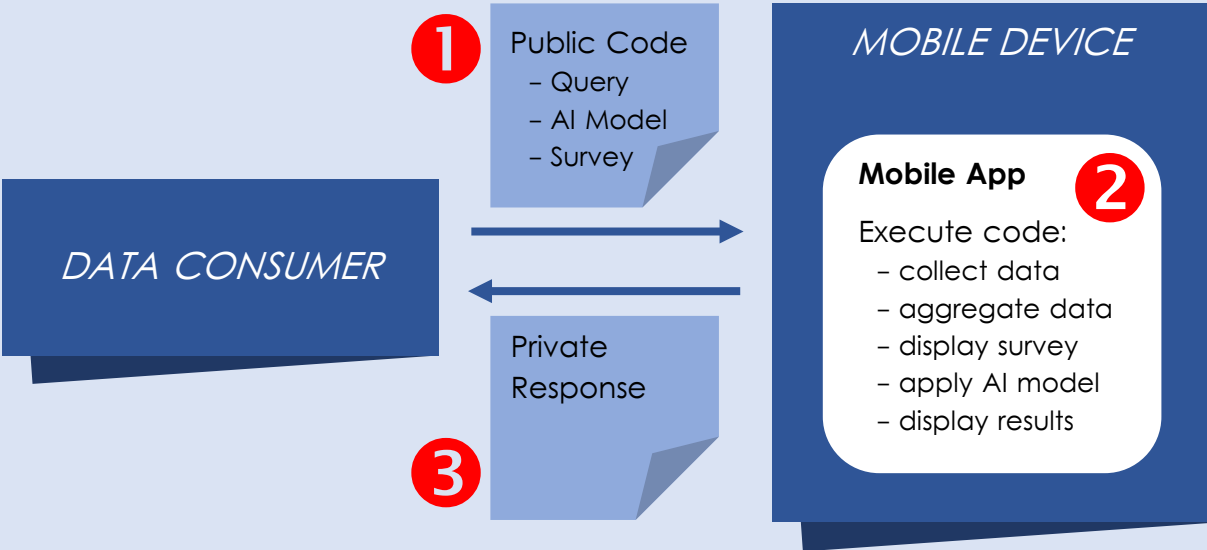


Figure 1. A simplified workflow of the open algorithm concept with the utility of blockchain and encryption algorithm omitted.



4. The Human-AI Ecosystem

4.1. HAI Token Technology

The Human-AI token (HAI) is a token based on Ethereum, which is a blockchain platform that runs smart contracts. HAI tokens are the currency for services performed in the Human-AI ecosystem. Data consumers define the fee in HAI for data they are interested, and data providers get remunerated in HAI by sharing the data. AI service providers set an amount of HAI tokens in smart contracts and anyone paying the amount will have access to utilize the corresponding predictive models. HumanAI AG will charge a marginal fee for transactions in the ecosystem to support the continuous development and maintenance.

4.2. System Overview

Figure 2 illustrates an overview of the Human-AI ecosystem. It is separated into a user space and a service space by blockchain. The user space consists of user interfaces and a data engine to deal with data access, control, and interactions with smartphone users. The service space focuses on the data usage part of our solution. Data consumers and/or service providers can operate on collected user data and build service applications on top of it.

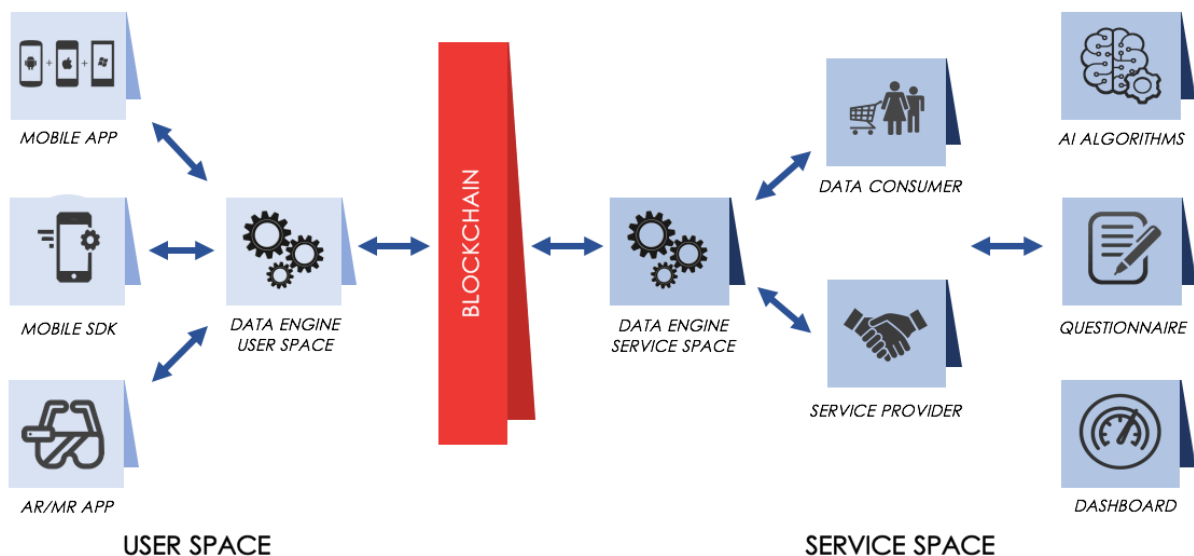


Figure 2. Overview of the Human-AI ecosystem.



The User Space

Figure 3 shows the system components in the user space of the Human-AI Ecosystem. It consists of four layers, namely user interface, data module, control layer, and persistence layer.

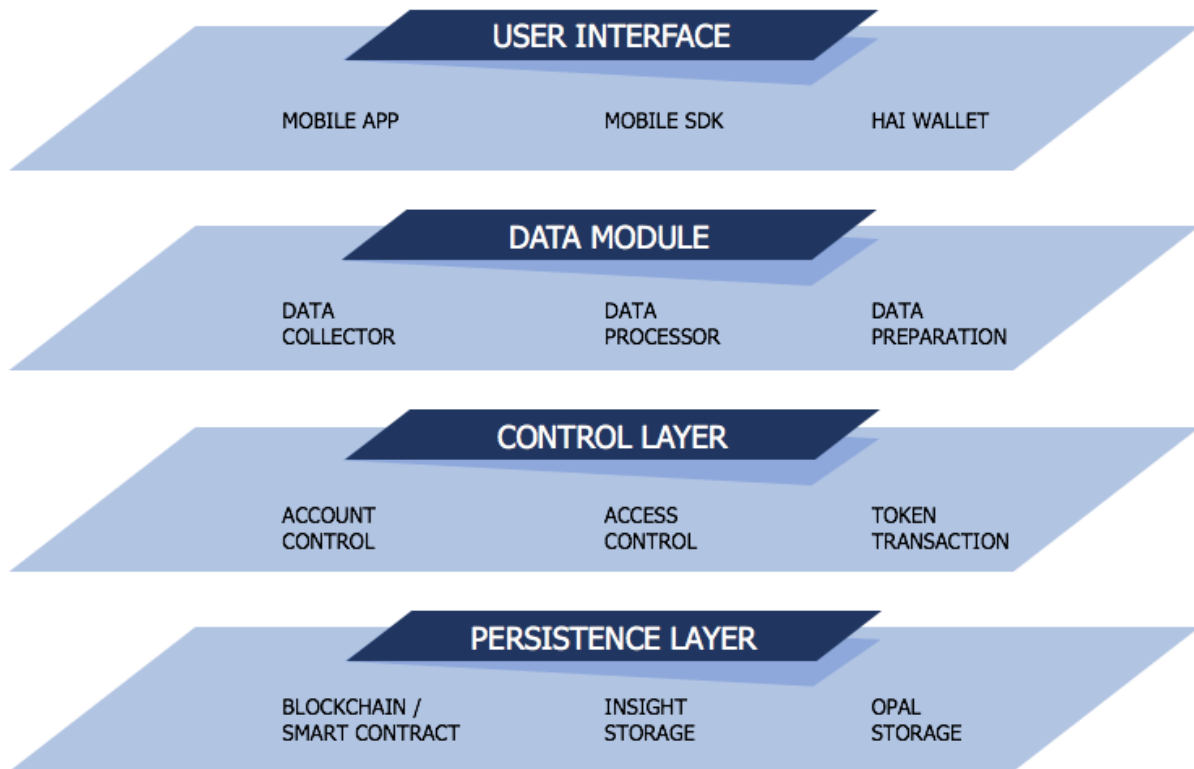


Figure 3. System layers in the user space.

The user interface layer controls all interactions with end users as data providers and it consists of user applications (e.g., mobile app, mobile SDK, etc.) and a blockchain-based token wallet. A user application makes it easy for users to interact with smart contracts, to select what data to share with what stakeholders, and to define a user-preferred level of privacy. In addition, users can send and receive HAI tokens through the integrated wallet.

The data module serves for all data-related operations. The data collector gathers personal data from mobile devices per smart contract requests, which is further aggregated and calculated by the data processor to turn raw data into relevant knowledge. In the end, data will be cleaned and standardized to make it suitable for transmission and ready for AI model training or prediction. Encryption and



anonymization will also be conducted by the data preparation module to protect user privacy.

The third layer manages security, including the control of user account, personal data access, and token transaction. It deals with the fourth layer, the persistence layer, for blockchain interaction and data storage. In the Human-AI ecosystem, raw data will stay in the data module on user devices, whereas resulted knowledge and insights will be encrypted and saved into the insight storage. Hashes of knowledge data will be added to blockchain for integrity checks. Our solution will be first deployed on the Ethereum blockchain due to its current maturity and adoption level. However, the solution will be independent of a specific blockchain technology, which means it can be easily plugged into other platforms like NEO and EOS.

The Service Space

Figure 4 demonstrates the four components in the service space of the Human-AI ecosystem. The persistence and control layers remain the same as those in the user space and deal with user access, data storage, OPAL integration, and blockchain transactions.

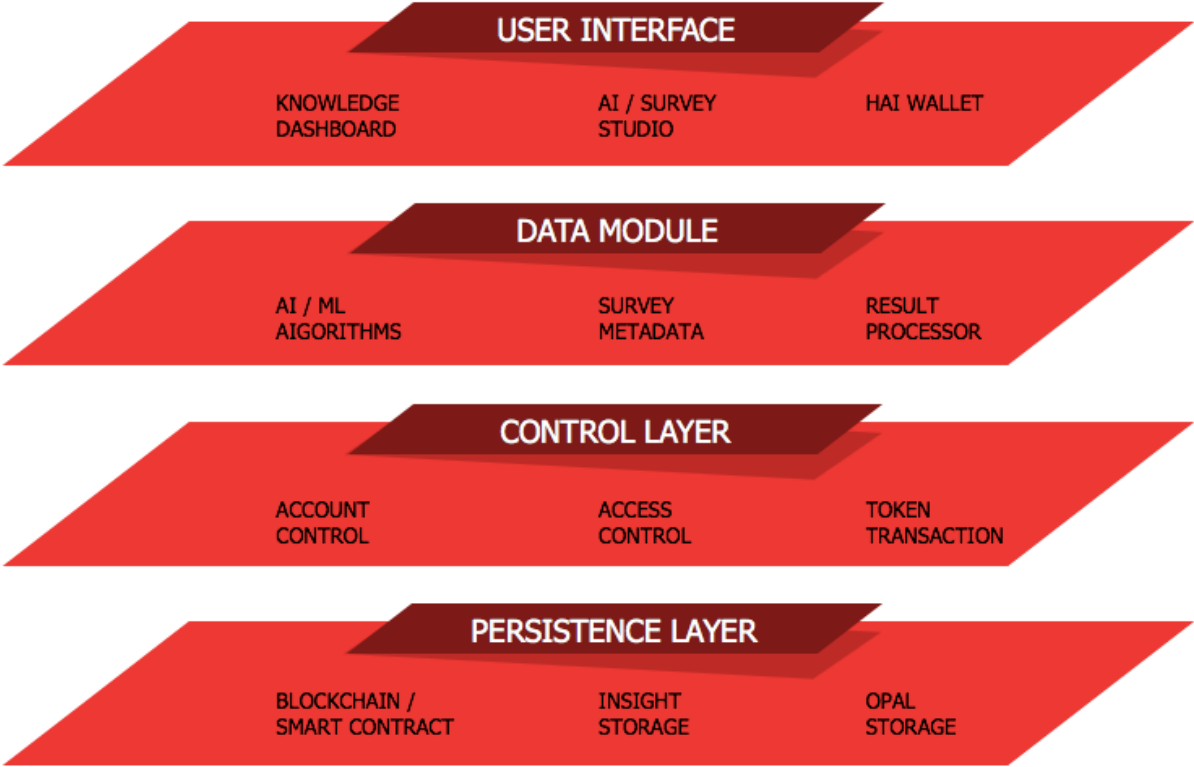


Figure 4. System layers in the service space.



Instead of processing raw user data, the data module in the service space will operate on the encrypted and/or aggregated knowledge, survey answers, and AI algorithms. Based on the data module, business applications and services can be developed and deployed.

The user interface layer will provide collected knowledge and insights in dashboards for data consumers. Through the interface, data consumers can also define precisely what data the data module needs to collect for what purpose, and how many HAI tokens each data provider will receive in return for sharing his/her data.



5. Products

5.1. The First Product:

Unlocking Mobile Personal Data for AI

Our first product aims at unlocking and monetizing mobile personal data on smartphones. Each user's mobile attention, which means how s/he spends time on different mobile apps, will be our focus in the beginning. Other types of mobile personal data such as location and movement, as well as answers to questionnaires will also be unlocked in the product. A mobile app will be provided with the following functions:



- Display a user interface so that users can choose which data to share, which data queries to perform, and which AI models to apply.
- Integrate advanced edge computing technologies to keep personal data private and secure on device.
- Collect, aggregate, and prepare user data on mobile devices. The data can be historical, in real-time, or collected continuously.
- Control data access and account management.
- Provide a HAI wallet for token management and transactions.

5.2. The Second Product:

A Mobile SDK to Scale up

The second product is a mobile SDK, with which businesses can integrate their existing apps into the Human-AI ecosystem. It helps them stay in compliance with new data regulations such as GDPR. The SDK provides the same features as the first product, but with extended data type. In addition to mobile personal data and user feedback data, mobile app data can be further unlocked to smartphone users. Consequently, users will be able to use features of the Human-AI ecosystem to easily and securely share and monetize personal data in any mobile app. On the other hand, data consumers will be able to combine personal data from multiple companies to provide new services.



5.3. The Third Product: **Moving towards AR / MR**

We believe that AR and mixed reality (MR) will become the next generation consumer electronics after smartphones, enabled either by new devices (e.g., Microsoft HoloLens, Magic Leap headset) or by smartphone AR toolkits (e.g., Apple's ARKit, Google's ARCore). In addition to data collected on smartphones, AR provides other types of data that can serve better for user interaction and personalized marketing. For instance, AR devices empower the possibility to track eye movement on the one hand, and to conduct real-time image recognition on the other hand. Integrating and analyzing such data helps us understand more precisely about each user's actual attention and interest. Our third product will extend the first two products to move from smartphone towards AR environment.



A simple use case could be as follows: A company wants to understand the impression of its new marketing advertisement on the street. It sends the request to our product, which will focus on detecting the advertisement on AR devices of users who have accepted to share their attention data. In the end, aggregated knowledge showing when, where, and for how long a user looks at the advertisement will be sent to the company and the user will receive HAI tokens as a reward automatically. AI user profiling models deployed in the Human-AI ecosystem can also be called to further understand characteristics of each user. The sensitive raw data (e.g. video stream) remains on the user's device. Privacy is thus guaranteed.



6. The Team

6.1. Core Team



Remo Frey, Ph.D.
Co-Founder, CEO

Remo Frey is a senior researcher in blockchain and data science at ETH Zurich and a former visiting researcher at MIT. He completed his PhD in the Auto-ID Labs, a leading global research network of academic laboratories for disruptive technologies.

Previously, he worked five years as software developer and project leader in the finance industry. Remo has published several scientific articles about blockchain technology for secure data sharing and privacy preserving applications. He holds a Master in Computer Science at ETH Zurich focusing on Machine Learning.



Runhua Xu, Ph.D.
Co-Founder, CTO

Runhua Xu is a data scientist and developer with years of professional experience across large multinational corporations as well as startups. His expertise lies in machine learning and prototype development (embedded system, mobile and AR apps). He is an early-stage investor and developer of Ethereum and NEO. Runhua holds a PhD in Machine Learning at ETH Zurich. He was also a visiting scholar at University of Cambridge, focused on developing Internet of Things and blockchain solutions to supply chain management.



Valerius Huonder
Co-Founder, CPO

Valerius Huonder works as software engineer at a leading Swiss company in digitalization, security and innovation, where he develops state-of-the-art micro-service applications as well as cutting-edge cross-platform mobile and frontend apps. Previously, he gained a lot of practical experience in numerous projects as mobile/web developer and as research assistant. Valerius holds a Master in Electrical Engineering and Information Technology at ETH Zurich, with a specialization in computer and networks / distributed computing.



Andreas Bogner, Ph.D.
Blockchain Scientist

Andreas Bogner has been researching blockchain fulltime at ETH Zurich and at a major German tech company for two years now. He has built – amongst other PoCs – a tamper proof mileage certificate for used cars and an automated vulnerability scanner for Ethereum smart contracts. Having a strong background in software engineering and operations, he focuses on implementation aspects and security of blockchain applications. Andreas holds a PhD in Mathematics which maybe explains why he is so fascinated about statistics of blockchains.



Klaus L. Fuchs

Business Development

Klaus Fuchs is a doctoral researcher at ETH Zurich and has spent several years in Teralytics, where he was responsible for business development of a data analytics platform. His expertise lies in building applications on top of user data which he did in the mobile network sector and during his research at ETH in the health domain. He is an early-stage investor of Ethereum and has started Decentriq, a blockchain investment company. Klaus holds a MSc in Management, Technology & Economics of ETH. He was also a visiting scholar at Tsinghua University.



Johannes Hübner

Senior Developer

Johannes Hübner is a Fintech entrepreneur and has co-founded two startup companies as CTO and technical lead. He has also consulted several financial service providers on blockchain projects, and has mentored numerous Fintech and blockchain startups. He worked more than ten years as a software engineer, IT architect and IT consultant. Johannes holds a Master in Information at TU Munich and was a visiting scholar at Stanford University. He is pursuing a PhD degree at ETH Zurich focusing on financial literacy and blockchain.



Markus Kern

Co-Founder, Legal and Compliance

Markus Kern is a lawyer and now works in-house as senior legal counsel and head group compliance of a globally leading company in the medical device industry. He studied law at the University of Zurich and at the University of New South Wales (Sydney) with a specialization in corporate and commercial law. His expertise also lies in criminal and employment law and corporate governance and compliance.



Fabrizia Vollenweider

Business Administration, Marketing

Fabrizia Vollenweider is majoring in Business Administration at the University of St. Gallen with a focus on information technology. Additionally, she is working part time in the marketing and sales field at an IT service provider that is focusing on document and enterprise content management. Previously, she has gained practical experience from working in different positions at various organizations on an extracurricular basis at her University.

6.2. Advisors



Prof. Alex "Sandy" Pentland

MIT Media Lab
Co-Founder

Prof. Alex "Sandy" Pentland directs the MIT Connection Science and Human Dynamics labs and previously helped create and direct the MIT Media Lab, the Media Lab Asia, and Strong Hospital's Center for Future Health. He is one of the most cited authors in computer science and a serial entrepreneur. In 2012, Forbes named him one of the world's seven most powerful data scientists. Sandy co-leads the World Economic Forum (WEF) Big Data and Personal Data initiatives, and is a founding member of advisory boards for Google, AT&T, Nissan, Telefonica, the United Nations Secretary General, and Monument Capital.



Prof. Elgar Fleisch

ETH Zurich
University of St. Gallen

Prof. Elgar Fleisch is a Professor of Information Management at ETH Zurich and Professor of Technology Management at University of St. Gallen. His research interest focuses on the merger of the physical and digital worlds to an Internet of Things. He aims to understand this merge in the dimension of disruptive technology (blockchain, Web 3.0, IoT devices), applications, and business implications. All projects of his chair take place in close cooperation with industry, which resulted in numerous scientific papers and the introduction of nine startups.



Prof. Roman Beck

Head of the European Blockchain Center
University of Copenhagen

Prof. Roman Beck is Full Professor in within the Business IT department at IT University of Copenhagen. He is Head of the Technology, Innovation Management & Entrepreneurship (TIME) research group and Head of the European Blockchain Center. His research focuses on the role of IT service sourcing, services management, and services engineering with a special focus on IS outsourcing, social media, and virtualization. Roman has raised € 3.31 Mio research grants from the US and German National Science Foundation.

7. Token Generation Event

7.1. Token Generation

The generation of the HAI token will be controlled by a smart contract deployed on the Ethereum blockchain. The token will conform to the ERC20 standard.

The token generation event seeks to collect ETH equivalent to \$20M, which will allow HumanAI AG to build the HAI platform and operate in the global market. The roadmap in this white paper is a full version to be completed if the goal is reached. It should be considered as an innovative R&D project involving cutting-edge technologies.

- **Token Value:** The exchange rate between HAI token and ETH is dependent on the price of ETH when the token generation event starts. The value of each HAI token will be kept equivalent to \$0.05.
- **Token Contract Address:** It will be published on our Website and official social media channels when the token generation event starts.
- **Launch Date and Time:** There will be a pre-sale in 2018 Q2 and a public-sale in 2018 Q3. Details will be announced soon.

Generated HAI tokens will be transferrable 7 days after the end of the event.

7.2. Token Allocation

A total of up to 1,000,000,000 HAI tokens will be issued once the token generation event is concluded. They will be allocated in the following ratios:

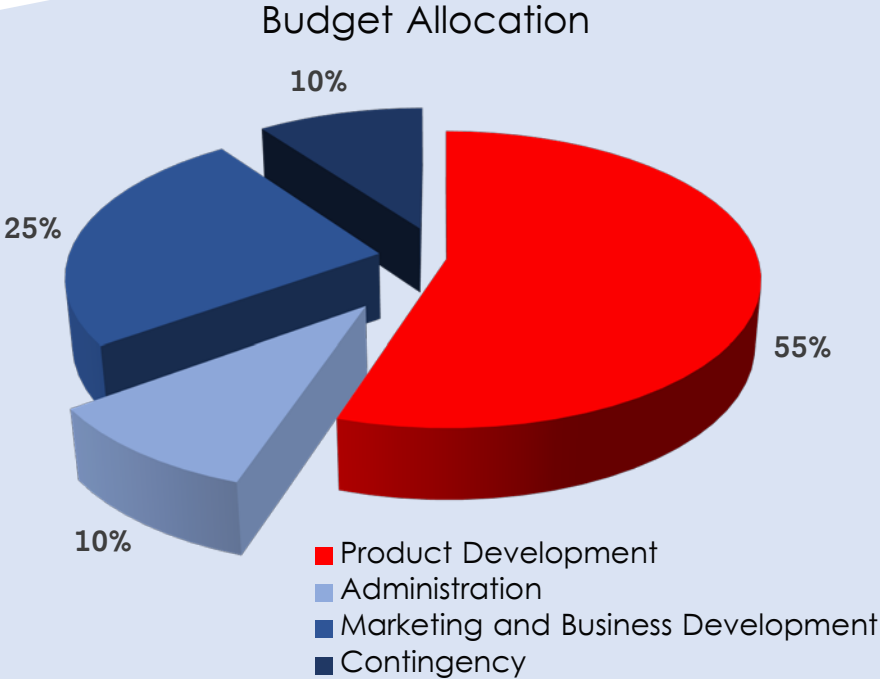
- 40% will be sold in the event.
- 25% will be used to incentivize users to adopt our products in the ecosystem.
- 20% will be reserved for HumanAI (vesting over 2 years).
- 10% will be used for partnerships and community.
- 5% will be used for bounty programs and cost of launching the token generation event.



7.3. Budget Allocation

The raised funding will be used in the following areas:

- Product Development Cost (55% of the budget): It includes the costs for software development, data security, AI model integration, and research on cutting-edge encryption and edge computing algorithms.
- Administrative Cost (10% of the budget): Consists of offices, equipment, legal and compliance, security, accounting and other administration costs.
- Business Development and Marketing Cost (25% of the budget): It includes efforts to promote products, expand awareness, build customer loyalty and community network, involve and incentivize partners, support the use of our SDK, and enhance business relationships.
- Contingency (10% of the budget): It will cover any extra costs that might come up.



8. Milestones & Roadmap

2014 Q3

Start research activities in mobile personal data and relevant business cases at ETH Zurich and University of St. Gallen. Grant fund from the National Commission of Technology and Innovation in Switzerland.

2015 Q1 – Q4

Build prototypes for collecting mobile personal data and release mobile apps in Google Play Store.

2016 Q2 – Q4

Develop AI user profiling models on mobile personal data.

2016 Q3

Second grant fund from the National Commission of Technology and Innovation in Switzerland.

2016 Q4

Validate business cases with large-scale field studies (75,000 users).

2017 Q1 – Q4

Conception and Development of the OPAL system (paradigm of open algorithms) by the Human Dynamics group of Professor Alex "Sandy" Pentland at MIT Media Lab.

2017 Q4

Complete HAI white paper.

2018 Q1 – Q2

Found the company and announce the token generation event.

2018 Q3 – 2019 Q3

Develop and release the first product "Unlocking Personal Smartphone Data for AI", as described in this document. Integrate OPAL in the mobile environment. First Release 2019 Q2.

2019 Q1

Start of cooperation with the Center for Digital Health Interventions at ETH Zurich and University of St. Gallen.

2019 Q3 – 2020 Q4

Develop and release the second product "Mobile SDK to scale up". First Release 2020 Q2.

2021 Q1 – Q4

Develop and release the third product "Moving towards AR / MR" First Release 2021 Q3.

9. Disclaimer

HAI token is a means of payment. No other rights are associated with the HAI token, in particular no share in the future company earnings or future capital flows, nor is there any right for repayment. Nothing herein constitutes an offer to sell, or the solicitation of an offer to buy, any tokens, nor shall there be any offer, solicitation or sale of tokens in any jurisdiction in which such offer, solicitation or sale would be unlawful. You should carefully read and fully understand this white paper and any updates. Every potential token purchaser will be required to undergo an on-boarding process that includes identity verification and certain other documentation, which you should read carefully and understand fully because you will be legally bound. Please make sure to consult with appropriate advisors and others. This white paper describes our current vision for the Human-AI system. While we attempt to realize this vision, please recognize that it is dependent on quite a number of factors and subject to quite a number of risks. It is entirely possible that the Human-AI system will never be implemented or adopted, or that only a portion of our vision will be realized. We do not guarantee, represent or warrant any of the statements in this white paper, because they are based on our current beliefs, expectations and assumptions, about which there can be no assurance due to various anticipated and unanticipated events that may occur. Please know that we plan to work hard in seeking to achieve the vision laid out in this white paper, but that you cannot rely on any of it coming true. Blockchain, cryptocurrencies and other aspects of our technology and these markets are in their infancy and will be subject to many challenges, competition and a changing environment. We will try to update our community as things grow and change, but undertake no obligation to do so.



10. Scientific Publications

The selected publications are written by our team members. The publications demonstrate that we have been intensively dealing with the topics of data science, prediction models and AI, blockchain and privacy for several years. The findings described in the publications will be incorporated into our system. Furthermore, the list of authors of the publications shows that many of our team have been working together successfully for years. We are a committed team and trust each other.

10.1. Blockchain and Privacy

- Frey, R.M., Bühler, P., Gerdes, A., Hardjono, T., Fuchs, K., Ilic, A., "The Effect of a Blockchain-Based, Privacy-Preserving System on Disclosure of Personal Data", *Proceedings of the 16th IEEE International Symposium on Network Computing and Applications (NCA)*, Cambridge, MA, USA. 2017.
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- Frey, R.M., Miller, G.A., Ilic, A., Fleisch, E., Pentland, A.S., "Wild Animals in Daily Life", ***Nominee Most Innovative Short Paper***, *Proceedings of the 38th International Conference on Information Systems (ICIS)*, Seoul, South Korea. 2017.
- Chanson, M., Bogner, A., Wortmann, F., Fleisch, E., "Blockchain as a Privacy Enabler: An Odometer Fraud Prevention System", *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers*, Maui, Hawaii. 2017.
- Frey, R.M., Hardjono, T., Smith, C., Erhardt, K., Pentland, A.S., "Secure Sharing of Geospatial Wildlife Data", *Proceedings of the 4th International ACM SIGMOD Workshop on Managing and Mining Enriched Geo-Spatial Data (GeoRich)*, Chicago, IL, USA. 2017.
- Frey, R.M., Wörner, D., Ilic, A., "Collaborative Filtering on the Blockchain: A Secure Recommender System for e-Commerce", *Proceedings of the 22nd Americas Conference on Information Systems (AMCIS)*, San Diego, CA, USA, 2016.
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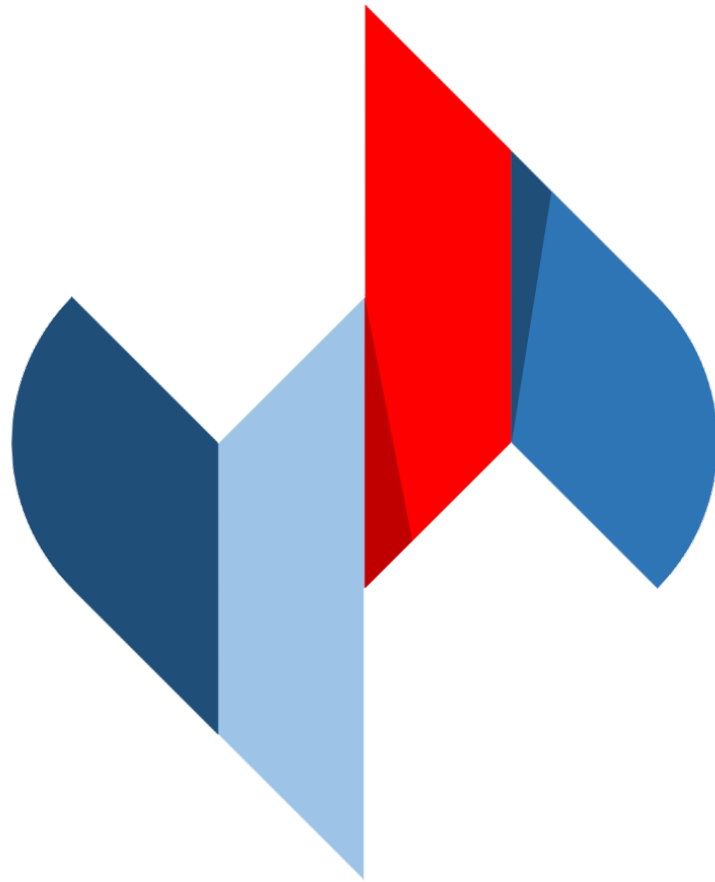
10.2. Predictive Models from Mobile Devices

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- Xu, R., Frey, R.M., Vuckovac, D., Ilic, A., "Towards Understanding the Impact of Personality Traits on Mobile App Adoption – A Scalable Approach", *Proceedings of the 23rd European Conference on Information Systems (ECIS)*, Münster, Germany. 2015.

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