Whitepaper

Computer vision surveillance technology powered by fog network of miners

Table of contents

1.

Executive summary

Vision & Mission

Executive summary

Video surveillance systems are currently the most efficient technical tool to ensure public safety by the means of recording facts and controlling the situation at any site. The global increase in crime, terrorist attacks and, most especially, public concern about safety are the factors that promote the development of the global video surveillance market. According to Markets&Markets, the industry's turnover reached $30.37 billion in 2016. The growth rate is seemingly unabated, as the industry is expected to reach **$75.64 billion in turnover by 2022.**

The volume of the video surveillance market
Source: Markets&Markets

2016
$30.37 Bn

CAGR 16.43%

2022
$75.64 Bn
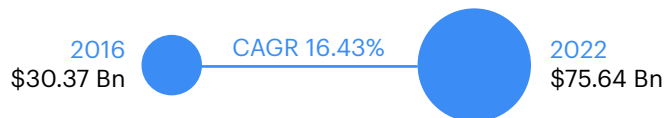
The problem is something similar – most video surveillance systems are of little use, and therefore inherently inefficient, since it is only possible to record data via videos, and store video archives. They are therefore backward-looking and dumb in that they cannot, and are completely unable to react to a situation when it is actually happening in real time.

Computer vision technologies are **expensive to develop and require the additional expense of requiring substantial computing resources to run**. Only a few very expensive B2B solutions have computer vision and video content analysis implemented as a part of their technology stack. As a consequence, their technologies are still very early-stage compared to the possibilities offered by the vast potential of neural networks. There are currently no products to analyze video streams by means of objects, faces or event recognition that are remotely **affordable to consumers.**

Faceter is the first decentralized surveillance system for consumers. Faceter makes video surveillance smart, giving brains to cameras through enhanced face detection, object detection and real-time video analysis. These features allow cameras to understand the situation and respond to it, offering much better security to all the customers.

Computer vision technology on the blockchain **powered by a decentralized network of miners** makes the product affordable for all-sized businesses and mass market consumers. The benefit from a mining perspective is that a contribution of miner's resources to Faceter is twice as profitable as the mining of Ether on the same Graphic Processing Units (GPU's)*. At Faceter's technological core is the absolute respect for privacy, and the utilization of the features of convolutional neural networks to split the tasks reinforces this commitment. As a result, sensitive data is always processed in a completely trusted environment, and all images not subject to recovery are passed to the decentralized network. This amounts up to 80% of the total amount of calculations performed.

Faceter plans to fill this niche by offering a product with broad functionality and an affordable price to mass consumers, such as small businesses and ordinary people.

* Compared to estimated profit from mining Ether with two NVIDIA Tesla M60 graphics cards (2x16Mh/s).

2.

Faceter's background

From Idea To Product

Faceter's background

One of the project's founders – Robert Pothier – came up with an idea of creating Faceter after realizing that video surveillance systems, which are supposed to ensure security, do not actually work. At the same time, current crime rates in South Africa, where Robert lives, create a strong demand for security systems from large companies, individuals and small businesses. Large enterprises can afford to buy and maintain expensive modern video surveillance systems powered by intelligent software, whereas individual users and small businesses are deprived of this opportunity.

Robert envisaged great potential that would come from creating a smart video surveillance product at an affordable price which anyone could use. Thus, the idea of Faceter was born. The product was based on the experience acquired by Robert and his development team in their previous project: Pay.Cards. It is an open library for the recognition of information from bank cards created under the supervision of Vladimir Chernitsky as a CTO. The project has been very successful with the library having been downloaded more than 25,000 times, and Pay.Cards technologies have been applied in a variety of commercial areas around the world.
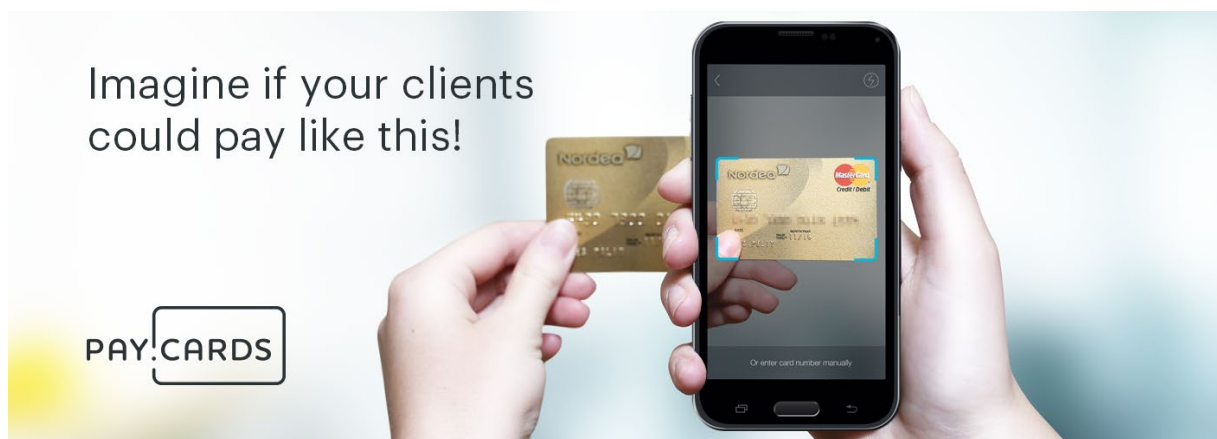
Vladimir Chernitsky supported the idea of creating an intelligent system for video surveillance and accepted the offer to become Faceter's co-founder and CTO. In this role, he applies his twenty years' experience in creating high-tech software products and his four years' experience in research and development of neural networks capabilities to recognize visual information.

As a professional with international business management experience, Robert assumed the role of CEO. The project received investments from a business angel to the amount of $1.2 million. Within one year, the project team created the first beta version of the product and launched several pilot projects with various companies in South Africa in order to test Faceter technologies, including an industrial enterprise, a casino network, a network of pizzerias, and one of the largest banks in the country.

Faceter's Milestones

2014

Vladimir Chernitsky joined the team that was working to create a solution for scanning bank cards using computer vision. By that time, he had already been engaged in research and development in the field of computer vision and artificial intelligence (deep learning) for one year. The team tested all marketable products available on the market and found out that none of the open source libraries available at the time made it possible to create a simple and efficient bank card scanner. Under the supervision of the new CTO, the team developed a plan to create its own product.

2015 (Q1-Q2)

The team launches its first successful product in the field of computer vision: Pay.Cards. An open source library for iOS and Android platforms allows users to embed a bank card scanner into mobile applications. The scanner is capable of recognizing not only the card number, but also the validity period and the card holder's name. According to the test results, the product is recognized as one of the best on the market and outperforms such competitors as cards.io and Apple Pay.

PAY.CARDS

Download the library on Pay.Cards website
pay.cards

Source code
github.com

2015 (Q3-Q4)

An idea is born to apply the team's accumulated experience to achieve a bigger goal: to create a public security system powered by face and object recognition technology. The team starts working on the project called "scanface".

2016

The team develops and tests a variety of neural network training algorithms and achieves high accuracy of face recognition. These developments form the basis of a product called Scanface (scanface.io). The created algorithms demonstrate high results in Megaface and LFW tests.

2017

The first pilot projects to test the product in real conditions in South Africa are launched. Representatives of these companies are satisfied with the test results and are ready to sign contracts to use the product for commercial purposes. The team is full of enthusiasm to make face detection and video stream analysis algorithms available to mass users.

2017

Scan Face → FACETER
Know the people around you

Scanface project has been renamed to Faceter. The team develops a plan to create a cloud service on the basis of available technologies which would be affordable for regular users and small business. To achieve this purpose, the company plans to use decentralized distributed computing technologies (fog computing), which allows for a significant reduction in infrastructure and product costs.

The team decides to run a crowdfunding campaign to attract investments in order to create a Faceter version for mass consumers.

The Faceter project team is driven by its experience of working together on related projects and the belief that technologies for organizing public and personal security using video surveillance will become more intelligent by 2030. Video stream processed by computer vision will cover up to 70% of public spaces in developed countries and up to 50% in developing countries, which will help reduce crime rates and facilitate crime detection.

" Faceter is an advanced intelligent software for videostream analysis and facial recognition for business,government and consumers, developed to significantly reduce crime in society.

Robert Pothier
CEO, Co-founder

3.

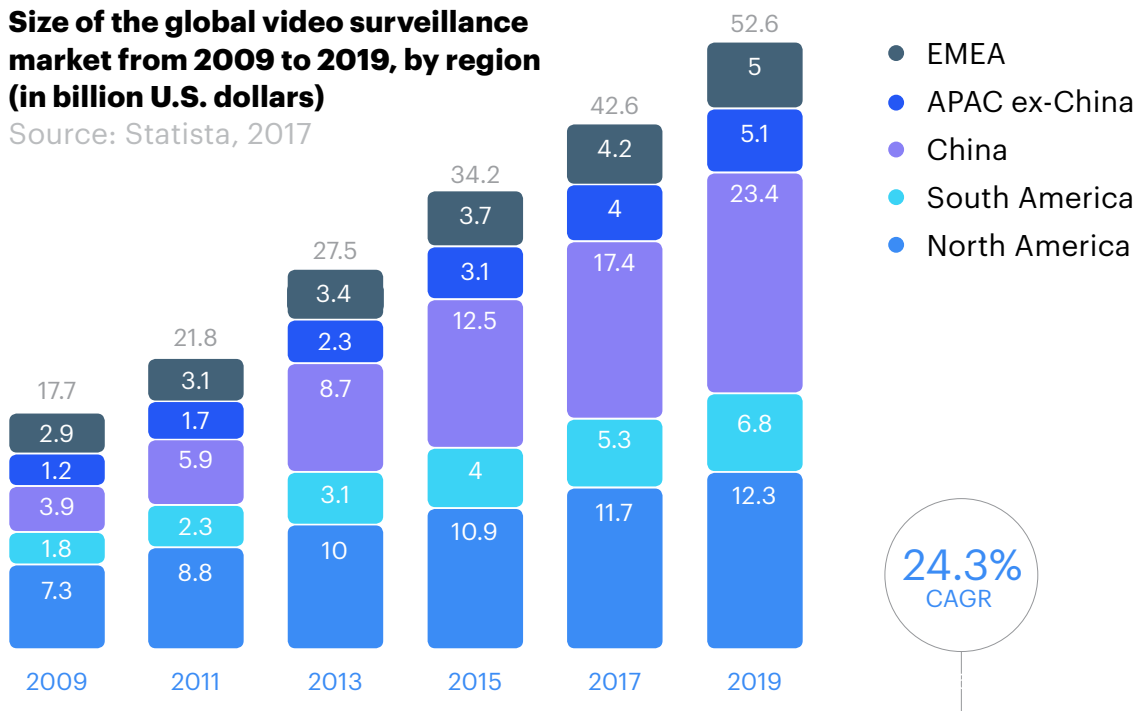# Market

Demand For AI-Surveillance

3.1 Overview and trends in the video surveillance market

CCTV (Closed Circuit Television) is currently the most effective technical security tool that allows its users to quickly record any actions. Thanks to the development of computer vision technologies, the capabilities of such systems have significantly expanded.

Over the last five years, the surveillance market volume (hardware, software and services) has demonstrated an annual growth of 15.4% and, according to Markets & Markets, **is projected to reach $75 billion by 2022**. High crime growth rates, an increase in the number of terrorist attacks, and people's concern over security are the main factors stimulating the development of the video surveillance market around the world.

Size of the global video surveillance market from 2009 to 2019, by region (in billion U.S. dollars)
Source: Statista, 2017

Legend:
- EMEA
- APAC ex-China
- China
- South America
- North America

2009 (Total 17.7): EMEA 2.9, APAC ex-China 1.2, China 3.9, South America 1.8, North America 7.3

2011 (Total 21.8): EMEA 3.1, APAC ex-China 1.7, China 5.9, South America 2.3, North America 8.8

2013 (Total 27.5): EMEA 3.4, APAC ex-China 2.3, China 8.7, South America 3.1, North America 10

2015 (Total 34.2): EMEA 3.7, APAC ex-China 3.1, China 12.5, South America 4, North America 10.9

2017 (Total 42.6): EMEA 4.2, APAC ex-China 4, China 17.4, South America 5.3, North America 11.7

2019 (Total 52.6): EMEA 5, APAC ex-China 5.1, China 23.4, South America 6.8, North America 12.3

24.3% CAGR

Modern video surveillance software allows devices to automatically perform a variety of tasks in an automatic mode without human intervention – from simple motion detection and counting the number of people and cars to compiling databases of people and vehicle numbers.

Video surveillance for "smart cities"

Twenty years ago, people started installing video cameras in public places in large cities. Today it is an indispensable element of security systems, both in private and public areas. It is one of the components of intelligent transport systems and an indispensable element of smart cities' infrastructure, which is one of the fastest growing markets.

The global Smart cities market
Source: Research and Markets, July, 2017

2016   CAGR 19.08%   2025
$773.19 Bn $3651.49 Bn
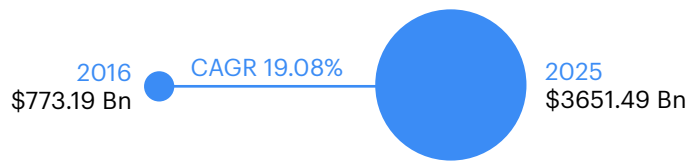
In smart cities, CCTV is used to record violations of traffic rules, to control the operation of municipal services, to restrict access to closed areas, as well as in parking and toll payment systems on high-speed roads.

In 2016, in developed countries, there were about 200 CCTV cameras per 1,000 residents of large cities.

Video surveillance systems for small businesses and individual users

The number of cameras installed in private homes, shops, restaurants, gas stations, and offices is growing every year and so is the demand for more advanced solutions. However, modern software for "smart" video surveillance is currently not available to individuals and small businesses because of high costs and a lack of development focused on this particular target audience.

According to the forecast of Market Research Future, the global market of home CCTV cameras will grow by 11% per year from 2017 to 2023 and during this period may reach $8 billion or 10.7% of the entire video surveillance systems market.

The global home security camera market
Source: Market Research Future, August, 2017

2017   CAGR 11%   2023
$4.27 Bn $8 Bn

Transition to IP-based surveillance systems

In 2014, the IHS company completed a ten-year study which revealed that around 245 million professional CCTV cameras are used around the world. Also, an analysis was made regarding the types of cameras used. The results showed that 20% of the installed equipment was represented by network cameras, and only 2% of equipment used was new digital CCTV cameras transmitting high-definition images. All other devices used were analog video cameras.

According to Allied Market Research, analog cameras, which began to be installed in developed countries about 20 years ago, are now being replaced by digital ones powered by IP. The market volume of such devices is projected to increase by almost 20% per year despite the fact that their cost is constantly decreasing.

IP video surveillance and VSaaS market forecast
Source: Allied Market Research
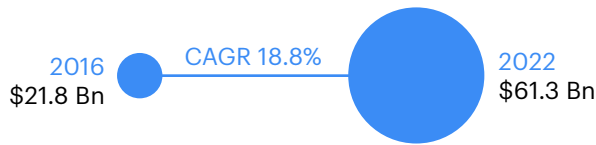
IP-based video surveillance technologies have revolutionized the industry offering a higher level of flexibility and scalability compared to older-generation video surveillance systems. IP cameras allow their users to use innovative technologies for video stream analysis. According to experts from leading international companies, such as Accenture, IHS Markit, PwC (data-driven city concept) and some others, the demand for intelligent video surveillance systems capable of analyzing video streams in real-time mode has grown significantly in recent years and will continue to grow.

High demand for face recognition software

The latest developments in the field of machine vision caused video surveillance systems to reach a new level. Technologies powered by neural networks and artificial intelligence elements allow their users to recognize faces in video streams in real-time mode.

According to the forecast of Allied Market Research, one of the most important factors affecting the global market for facial recognition systems is the growing demand for "smart" software for video surveillance systems.

Top factors impacting the world facial recognition software market (2015 vs 2022)
Source: Allied Market Research
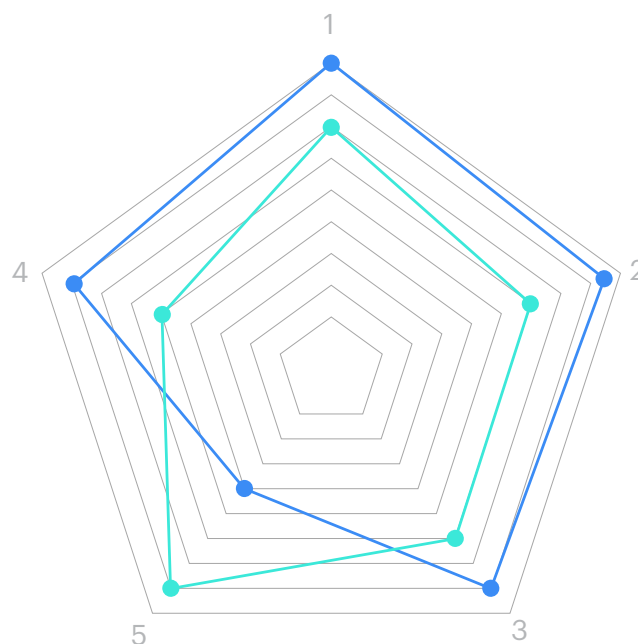
1   **Rising demand for surveillance systems for enhancing safety and security**
The major driving factor of the market was the increasing demand for advanced security & surveillance systems in civil and government agencies to enhance safety and security. Burgeoning data breach cases and brute force attacks have increased the demand for advanced surveillance systems, which in turn has increased the demand for facial recognition solutions.

2   **Increasing application in physical security and intelligent signage**
The significant increase in incidence of terrorist attacks on government organizations and the commercial sector in the recent years drives the companies and governments to implement robust physical security strategies. Moreover, this technology is expected to witness high adoption in intelligent signage application on account of rising concerns of security and use of marketing strategies to analyze the customers based on their age, gender, and other facial attributes. Over a period, physical security and intelligent signage are expected to fuel the demand of facial recognition technology.

3   **Technology advancements such as cloud-based services and 3D-based recognition systems**
Technological advancements are likely to reduce the prices of facial recognition systems in the future. Software development kit (SDK) technology has improved the accuracy in terms of recognizing facial features. Therefore, the improved quality of products enhances awareness amongst users, which in turn is expected to increase adoption of facial recognition biometrics in the future.

4   **Increasing application in mobile security and drones**
Increasing demand of facial recognition in smart devices, such as smartphones, laptops, tablets, and personal digital assistants, which are used for both personal and business purposes, presents various growth opportunities for the facial recognition market. Moreover, burgeoning number of drones in various commercial sectors, such as media & entertainment, inspection, and surveying, contributes to the rising demand of facial recognition. For instance, as per the Federation Aviation Administrator (FAA), around 30,000 drones are expected to be introduced by 2020. Therefore, these factors are expected to provide immense opportunity for the growth of facial recognition technology.

5   **Lack of accuracy and high implementation cost of facial recognition technology**
Currently, high implementation costs and low accuracy of the technology negatively affect the growth of the market. Costs such as maintenance and middleware costs also contribute to the implementation cost. However, few manufacturers, such as FaceFirst, Inc., have started using efficient algorithms, such as PCA, FFT, to improve accuracy and reduce the cost of facial recognition technology. Therefore, with the development in technology, lack of accuracy and high implementation cost of facial recognition technology are likely to reduce their impact during the forecast period.

Last year, Gartner analysts placed Face Recognition technology on the Hype Cycle Curve Human-Machine Interface curve in the "Into the Trough" area, which means a decline in market expectations.

This year, Face Recognition is Climbing the Slope. This means that within the next 2-3 years there will be an upsurge of interest from users, which will lead to the "plateau" stage – the maturity of demand and clarity regarding the advantages of this type of technologies.
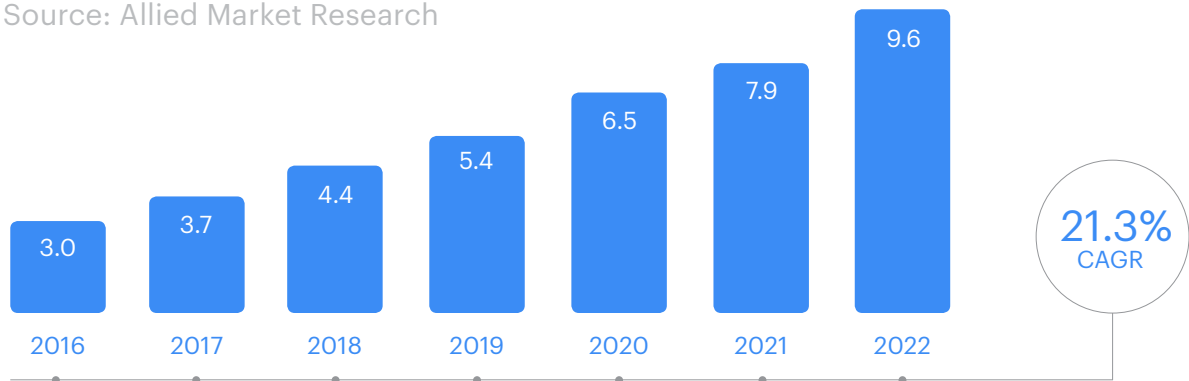
Gartner Hype Cycle Curve
Source: Gartner

Facial recognition global market forecast, USD, bn
Source: Allied Market Research

2016: 3.0
2017: 3.7
2018: 4.4
2019: 5.4
2020: 6.5
2021: 7.9
2022: 9.6

21.3% CAGR

The highest potential for applying FR technology is in the niche related to providing security in crowded places. However, current technologies are not capable of providing the necessary functionality and performance.

Application areas	Features	Potential	Notes
Security market	Automation of checkpoints, enterprise internal security systems	High	Technology requirements are low; the average check is moderate. Big market players cannot cope with a large number of small orders.
Retail	Marketing needs: selection of the most relevant products for customers	Medium	There is no significant urgency. Due to high prices, FR is often replaced by other authentication methods. Technology requirements are low.
Public security market	Identifying people in crowds and public places	High	High relevance and high demand, especially by law enforcement forces. However, an unattainable level of technology is required.
Banking	Systems for employee monitoring and customer recognition in banks	Low	The key player is Vision Labs which developed its product taking into account the segment's requirements. Also, the company has some large banks among its customers.
Social networks	Services for people search by photo, face recognition in photo and video	Low	Low solvency among the population. The key player is the Ntech company whose experience has not been really successful.

3.2   Competitive environment analysis

Most of the largest technology companies have recently hired **at least one team** which specialises in developing solutions in the field of facial recognition. Many companies develop these technologies on their own.

Number of acquisitions of AI-startups made by big players

Apple	facebook	Google	intel	amazon	IBM
4	3	3	1	1	1

Buyer	Who was purchased	Startup activity area	Deal price	Purchase scope
Facebook	MSQRD	Modifying videos containing faces in a real-time mode	$2—3M	Technology+team
	FacioMetrics	Emotion recognition of the face	N/A	N/A
	Face.com	Face recognition	$55—60M	Technology+team
Apple	Emotient	Emotion recognition of the face	N/A	Technology+team
	Polar Rose	Face recognition	$29M	Technology+team
	Faceshift	Creating animated avatars	N/A	Unknown
	RealFace	Face recognition	$2M	Technology+team
Google	Viewdle	Face recognition	$30—45M	Technology+team
	PittPatt	Face recognition	N/A	N/A
	Never Vision	Face recognition by photo	N/A	Technology+team
Snapchat	Looksery	Modifying videos containing faces in a real-time mode	$150M	Technology+team
Amazon	Orbeus	Face recognition by photo	N/A	Technology+team
Stylecaster	Daily Makeover	Applying makeup in photos	$2M	Technology+team
Kairos	IMRSV	Face and emotion recognition	$2.7M	Technology+team
Intel	Itseez	Developer: OpenCV (library of computer vision algorithms)	N/A	N/A
IBM	Alchemy	Natural language processing and face recognition	N/A	Product and community (40,000 client developers)

In addition to the major market players, there are several dozens of start-ups, which have received, according to various estimates, from 1.5 to $300 million in the form of venture investments. Most of these start-ups focus on a specific industry and are guided by specific requirements of B2B customers. The examples include NTechLab, Vocord, Visionlabs and some others. None of these solutions has full functionality for face recognition and video stream analysis. Also, products for the mass consumer are completely absent.

Company	Activity	Investments
Affectiva	Emotion recognition in video	$34.2M
Betaface	Media platform using face recognition technologies for searching and monetizing multimedia content. The platform is designed for news and entertainment media projects, advertising agencies, content producers, television and radio industry, video and photo archives, etc.	N/A
Face++	Computer vision technology of the latest generation consisting of 3 main blocks (image identification, pattern recognition and analysis). The proprietary SDK allows third-party developers to implement the technology in their own websites, mobile applications, Smart TV, etc.	$148M
Hyperlayer	The recognition of people's faces in the streets in real-time mode and the provision of their history (criminal, credit, etc.) – a technology for new-generation mobile devices (glasses, helmets, etc.)	N/A
Identix	Multi-functional equipment for biometric recognition of people (fingerprint, face, palm, retina) to protect the public from terrorism, criminal threats and fraud.	$18.8M
Kairos	Cloud access to recognition algorithms: Face Recognition API, Crowd Analytics SDK and Emotion Analysis API.	$3.65M
KeyLemon	Face and voice recognition to improve the interaction between computers and people.	$1.5M
ResolutionView	A tool analyzing time spent by employees at their computers and comparing that information to the number of hours reflected in report cards to monitor employees and minimize lawsuits for "overtime work".	N/A
Shenxing Tech	Chinese startup in the field of facial recognition and artificial intelligence.	$14M
Tascent	Development of high-precision products and technologies in the field of biometric recognition.	$18.5M
Uniqul	A payment system based on face recognition. The system allows its users to pay for goods with their "faces" without a purse, a card or a mobile phone, which helps to drastically reduce transaction time.	N/A

Competitive ecosystem

Source: based on independent research ordered by Faceter in the 1st quarter of 2017.

* – algorithm quality in this case is determined by the results of MegaFace international competition

Faceter plans to position itself in the upper right-hand corner offering a solution with high quality algorithms for a great variety of application areas.

4.

Current problems in the field of video surveillance

Way To Market Leadership

Current problems in the field of video surveillance

To date, the use of CCTV systems for security purposes has not lived up to its expectations. Such systems are mostly used for the continuous recording and storage of video archives. Street cameras only record what happens in the street. If a crime is committed, all that a policeman can do is watch a video, find a shot with a criminal's face, and send a picture of poor quality to other police offices. For example, in 2009, while investigating 95% of murders, Scotland Yard detectives used videos recorded by CCTV. However, this did not help the victims of those murders.

Obviously, such functionality is not sufficient to ensure high levels of security. According to numerous studies, the installation of cameras significantly reduces the number of crimes in parking lots (by 51%); however, in city centers and in the streets, the situation improves by no more than 10%. In some countries, there have been no significant changes in the criminogenic situation since the introduction of CCTV, which makes these technologies virtually useless.

The potential of CCTV is enormous. Due to new developments in face recognition technology and the use of an event-based security approach, CCTV can become a truly effective tool. The highest potential for FR technology is in the niche of public security in crowded locations.

What if a camera could be connected to intelligent software that is able to analyze events and automatically turn on an alarm system and call the police, firefighters or ambulance right at the time of the event?

What if a camera was able to recognize an offender's face in the offender database long before a crime is committed?

What if the system could immediately provide investigators with a list of all public places visited by a criminal over the last year, including the exact dates and times?

Such features are not yet available even in sophisticated urban systems. The first pilot projects to test automatic face recognition technologies in public security systems were launched in 2016. Video surveillance systems with such features as reaction to events, face recognition, comparison against databases, and other advanced features have already begun to be built into corporate systems. Such systems, however, are not scalable and cost a lot of money. The high cost of licenses and prohibitive IT infrastructure costs make them unaffordable even for medium-sized companies, not to mention small businesses and individuals.

Faceter plans to fill this niche by offering a highly functional product affordable for mass consumers, by utilizing all the benefits of decentralized computing an blockchain.

5.

Faceter's solution

What Makes It So Awesome

5.1   System description

Faceter's main component is a decentralized infrastructure where complex data processing using neural networks is performed using the decentralization powers of Fog Computing and Blockchain.

Faceter is a system that makes smart video surveillance and provides cameras with "eyes" – face recognition, object detection and real-time video content analysis. At the next stage, all these capabilities will be combined into a single feature: the ability to "understand" the situation and respond to it accordingly.

The low cost of such computations makes them affordable for small businesses and mass consumers; they can even be used in combination with the simplest video cameras connected to the Internet.

Faceter's Primary Features

Object and facial recognition and resultant behavioral analysis greatly enhances the capabilities of video surveillance systems to detect potential threats or such events as a smiling customer, a focused employee, etc. The technology's algorithm was proven by LFW and MegaFace test, which are the most trusted in the industry.

Convenient applications for any computer or mobile device allow users to access video surveillance systems from anywhere and without having to master complex and slow interfaces.
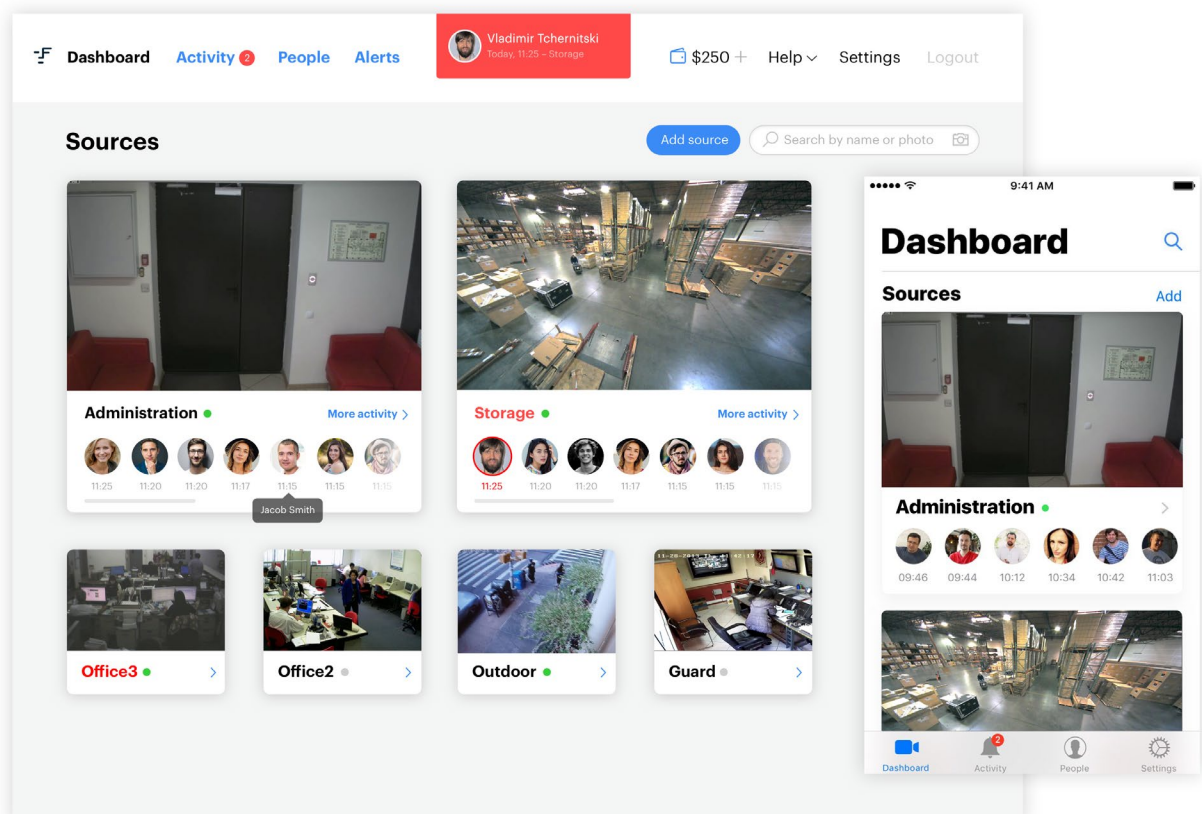
Fog computing — The cost of the product is significantly reduced by involving cryptocurrency miners into a decentralized computing network to perform recognition calculations with the added benefit of offering miners a higher income-earning opportunity.

Blockchain — Faceter uses all the nascent opportunities of smart contracts to deliver flexible and transparent payment options and as well as proof-of-recognition mechanisms to a Fog computing network. This is the way Faceter contributes to the growth of the crypto-industry.

Machine learning — using neural networks, you can teach Faceter to react on variations of certain events.

Data protection — Faceter does not process the source video stream outside its trusted environment; **only anonymized data is transferred to decentralized networks.**

The Faceter token is the "fuel" of a decentralized network enabling flexible, transparent, cross-border closed-loop settlement mechanism for all participants.

5.2   Competitive advantages

Most of the video surveillance software available on the market uses two parameters: recording time and source. This means that the user can only see what happened at a certain time on each of the installed cameras. Faceter greatly expands the possibilities of working with video.

Decentralization

The utilization of leading-edge decentralization technology via fog computing and Blockchain, Faceter is able to transform a previously fragmented and difficult to access industry into technology that all means of potential users can leverage too their particular advantage. The involvement of multiple mining sources, at incredibly attractive rates, makes this an opportunity that cannot help but succeed financially, across many different points of access.

Highly Accurate Facial Recognition

Thanks to the high-level facial recognition technology (confirmed by LFW and MegaFace tests), Faceter is able to:

– draw up a card file of office workers, family members, or restaurant visitors;

– generate a report indicating who and when was filmed by cameras;

– **track each case** of a particular person appearing in a certain place and issue specific records from the archive.
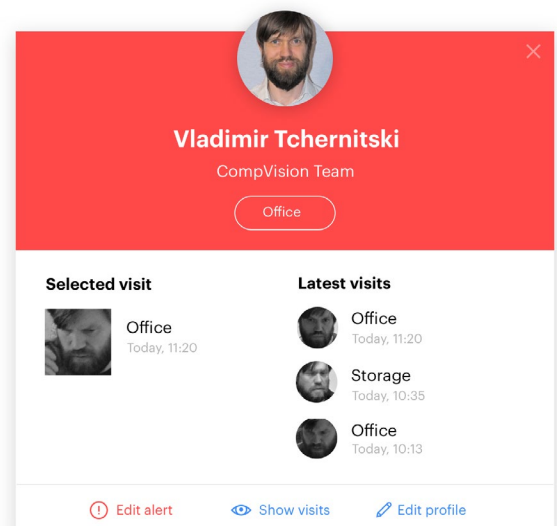
Integration Interface

Faceter can be "taught" how to respond to certain events. For example, the system can send SMS to parents when their child comes from school and transfer information through the API to integrated systems. It can be a smart home management platform that can give the microwave an instruction to automatically heat up food. In the next two years, Faceter will also be able to support the protocols of several leading smart home platforms and standard API callbacks. When integrated with urban services, Faceter can be configured to perform specific actions, such as sending alerts to 911 rescue service in the event that there are any signs of violence or a crime being prepared.

Truly Smart Surveillance

In future versions, in addition to detecting and recognizing faces, Faceter will also be able to:

identify emotions by facial expression and tone of voice; register cries for help or aggressive intonations, sounds of breaking glass or atypical noises;

identify objects of certain types in the camera's scope, including weapons, money, flames determine their characteristics, such as color, volume, weight;

recognize text and character sequences, such as in vehicle numbers;

"recognize" pets.

Affordability for the mass consumer

The cost of computing and storing data is one of the main expenditure items in products powered by AI and neural networks. Faceter's technology involves the use of distributed decentralized computing powers: fog computing. This approach allows to significantly reduce infrastructure costs compared to standard public cloud computing (AWS, Microsoft Azure, etc.) in proprietary or leased data centers, which makes Faceter's facial recognition and video stream analysis technologies affordable for the mass consumer.

5.3 Application areas

Faceter has developed a product version for corporate and government customers which can be used in many scenarios, both as a cloud service and a "boxed" solution. The main goal of the next stage is to develop a product for mass consumers based on decentralized computing powers (so-called "fog computing"). This technology helps reduce infrastructure and computing costs and makes the services more affordable.

B2C

Software designed for households can be used in apartments, offices, country houses, as well as in family shops and restaurants. Payment is made based on a monthly or annual subscription. The rates depend on the number of cameras used and the workload (the number of recognized faces per unit of time). Faceter's solution for individual users:

– increased security level;
– affordability;
– extensive applicability (integration with smart home technologies).

B2B

Software with extended functionality for enterprises can be used in factories, warehouses, large enterprises, hotels, casinos, shopping centers, banks, restaurant chains, etc. Thanks to the technology partnership agreements with vendors of household, office and industrial equipment and manufacturers of sensors and other components for smart devices, as well as organization and production management systems, Faceter will provide the following additional features:

Security based on video surveillance
Faceter allows users to significantly improve the performance of their security systems thanks to the event analysis approach. This technology allows users to detect outsiders in the territory of enterprises and offices, as well as to monitor the safety of objects and identify fire, non-standard noise, etc.

Personnel management
Faceter can automatically keep track of the time that each employee spends in the office and at their workplace; automatically recognize visitors and keep a log of visits; identify cases of employees' atypical behavior; recognize facial emotions, tone of voice, etc.

Customer relationship management
Faceter's analytical algorithms allow users to count the number of visitors and identify their gender, to keep a log of visits to specific clients, to note

any particularities of their behavior (for example, their interest in certain products), to detect queues at cash registers and notify responsible personnel accordingly;

Integration with existing solutions and equipment
Technological partnership with vendors of software and household, office and industrial equipment, including manufacturers of sensors and other components related to the IoT concept.

B2G

Software for municipalities can be used to analyze video stream in the streets and on roads, as well as in crowded places, railway stations, airports, and strategic facilities. It can also be integrated with databases.

Faceter assumes the possibility of recognizing an offender's face and running it through the entire database of archival records to reveal the places recently visited by such a person. The solution provides automated control over compliance with norms and regulations in transport and public places, which will increase crime detection rates and ensure higher levels of public security.

5.4   Future development

After Faceter is adopted by the market, it can be used to maintain white lists in a variety of services; for example, on websites where employees can be hired to do some housework. In addition to ratings and reviews, Faceter system can also store links to a blockchain record containing biometric identification data (vector facial recognition, voice recognition, etc.). The same method can be used to store the records of shop visitors and to check the integrity of buyers, sellers or couriers.

If all cameras connected to Faceter are integrated with police and rescue service databases, information about wanted criminals, missing children or people in trouble can be instantly sent through the system to find their relatives and places of residence. In such emergency cases, the police and special services will also be able to access the system in order to discover the "prints" of people in video archives of Faceter users without compromising confidential information, since the system will only use data for which the camera owner gave their consent.

" The Internet is called the "nervous system" of mankind through which "nerve impulses" are transmitted in the form of huge amounts of digital data, thus forming the collective knowledge. If we look at humanity as a single system that recreates the functions of a living organism, blockchain and the collective security approach can be perceived as one of the vital components – an immune system defending this organism from potential internal and external threats.

Robert Pothier
CEO, Co-founder

6.

Faceter technologies
Advanced and Deep Learning
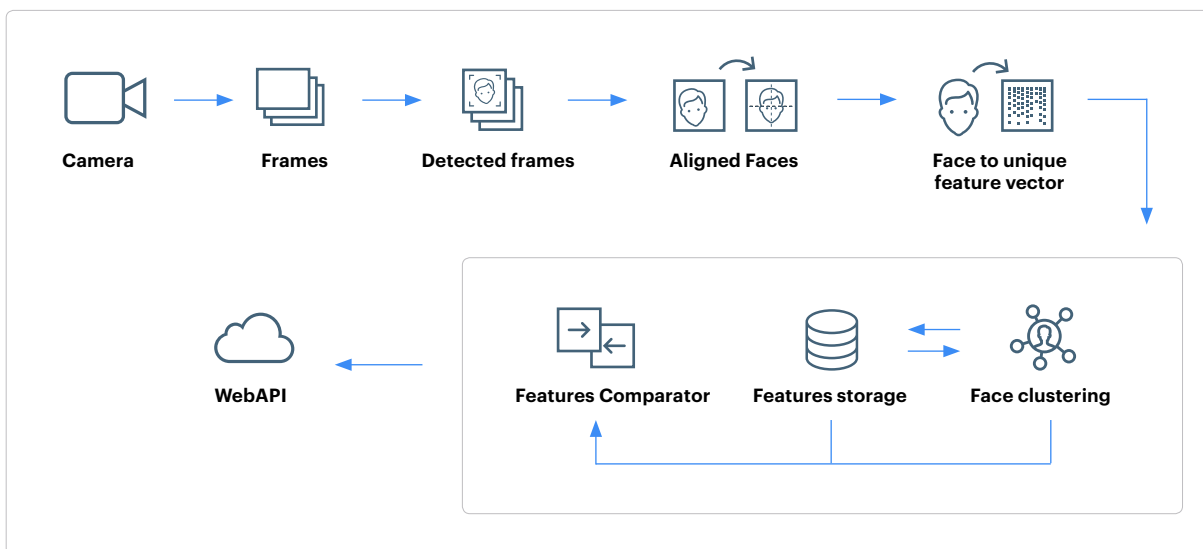
6.1 Data processing

The Faceter software complex is designed in the form of a set of modules each of which is executed at different system levels and is responsible for individual stages of the platform operation. The language of ML components development is C++11. In addition, GPU acceleration is actively used.

A server with computational capacities is required for offline solutions whose volume depends on the number of cameras and the frequency of people getting into focus. For the online solution, the user is required to log in to Faceter's website and add RTSP, HTTP or RTMP link to video camera. At the next stage of the product development, cameras will be automatically connected to ONVIF interface.

Stages of the face recognition process

1. Receiving and decoding video stream from camera;

2. Face detection (in case the camera is not equipped with built-in face detection technology);

3. Face alignment and framing for better recognition;

4. Obtaining a vector of characteristics for each person using deep convolutional neural networks;

5. Vector clustering, comparison of feature vectors with available databases and their placement in the storage system;

6. Results output through API.

Pipeline of facial recognition process

| Camera | Frames | Detected frames | Aligned Faces | Face to unique feature vector |

| WebAPI | Features Comparator | Features storage | Face clustering |

Distribution of computational resources by stages

Incoming Stream	Scene Frame	Detected Faces	Aligned Faces	Face features	Output stream	Face clusters/IDs

Stream decoding
CPU 100%
GPU 0%

Face detection
CPU 5%
GPU 95%

Face alignment
CPU 10%
GPU 90%

Facial features extraction
CPU 0%
GPU 100%

Encoding to output HLS stream
CPU 100%
GPU 0%

Clustering storage and comparator
CPU 80%
GPU 20%
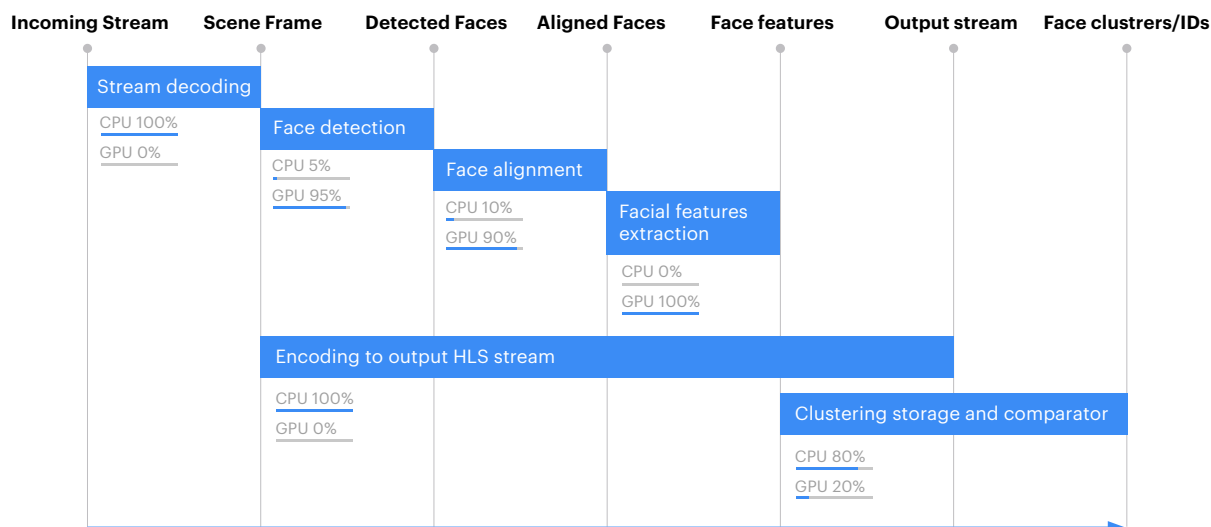
6.2   Faceter Decentralized Network

Due to the rapid growth of decentralized services, including blockchain-based services, Faceter plans to build its own computing network by means of attracting individual owners of GPU resources, as well as to use affordable solutions, such as SONM or Golem, instead of expensive cloud services. Thus, there will be no need to use the expensive monopolized services of Amazon, Microsoft, Google, etc.

The use of miners' resources or other idle computing power can be extremely beneficial both for the owners of these resources and consumers. Even a rough comparison of the cost of renting GPU servers on Amazon Web Services to the amount of compensation paid to miners for block calculations demonstrates a huge difference. In addition, the network complexity is adjusted every few months which allows for the reduction of miners' rewards, and after new consensus mechanisms are adopted, there will be no need for GPU computing at all.

Faceter platform operation

Cameras

Private zone

Video Hubs

Miners

The FOG
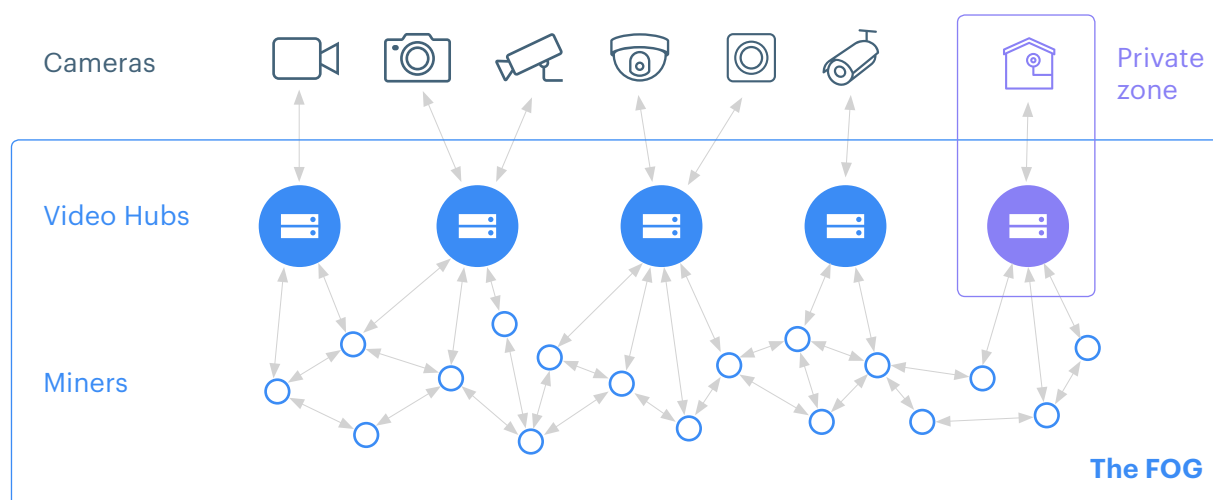
The main participants of Faceter network are the owners of GPU resources (Miners). A smart contract will be concluded with each of these nodes. This contract will be used to accrue compensation for the provision of computing capacity.

A decentralized environment requires special verification of the trustworthiness of connected nodes. In order to ensure the quality of computations performed, less productive nodes will be verifying the performance of other nodes and repeating calculations performed. High-performance nodes are supposed to be fully loaded with tasks, whereas less powerful ones will be given just fragments of the same tasks. The results of the calculations will then be compared by a smart contract, and if there are enough confirmations from participants, each of them will receive their portion of the reward from the formed balance. If nodes responsible for the verification receive a different hash of calculations, this will confirm a miner's bad faith and will lead to their disconnection and redistribution of accumulated reward among new computers. Faceter calls this concept "Proof-of-Recognition".

The distribution of tasks for the performance and verification of work will be dealt with by special orchestrator nodes (Video Hubs) which also act as video hubs and obfuscators of sensitive data. Such nodes will be located in the trusted zone unlike all other nodes working with impersonal data of no value.

6.3   Personal data protection

Users of video surveillance systems usually connect their cameras to cloud platforms. There are dozens of such cloud applications on the market serving a lot of people and companies (sometimes millions of them): Ivideon, Camcloud, XMEye, vMEyeSuper, etc.

All such services have access to CCTV cameras, but virtually none of them have developed a clear policy for handling user data; oftentimes, there is no proper means of controlling access to data.

Faceter's modular architecture allows users to work with original video stream in trusted environments: on camera owners' devices, on Faceter's servers, or in cameras themselves, if possible. Only obfuscated (impersonal) data is used to perform tasks on decentralized networks. In other words, such data cannot be converted to the original format with reference to the owner.

> " Consumer trust is our priority. At all stages of Faceter development, we are guided by the YOU OWN YOUR DATA principle, giving our customers an opportunity
> to fully control their personal data.

Robert Pothier
CEO, Co-founder

6.4   Faceter token use model

The effective operation of a decentralized network requires a flexible, transparent and transboundary settlement mechanism for all participants. Traditional approaches using fiat money are not viable in this particular case, since they don't fully meet any of these requirements.

It means that each potential network participant would have to pass an extended KYC check, open a foreign exchange account with their bank and execute an international transaction observing all the requirements of local legislation, which makes it virtually impossible to create a large-scale decentralized computing infrastructure.

The solution to this problem is Faceter's own token used as a basis for making payments between consumers of intelligent video surveillance services and network participants. Integration of the blockchain technology into Faceter platform is planned to be executed in several stages:

Stage 1: issue of tokens on Ethereum for free sale and internal economic purposes of the project, as well as for payment of remuneration to node owners ("miners").

Stage 2: development and launch of proprietary blockchain and possible token migration. This step is supposed to solve the problem of decentralized task distribution, increase the system's speed, ensure independence from Ethereum blockchain and reduce transaction costs within the platform.

System functioning model

Faceter's services can be paid for with tokens or other payment tools (bank cards, electronic wallets, cryptocurrencies). In order to ensure the normal functioning of the latter, Faceter will implement mechanisms for the instantaneous conversion of payments to tokens. The cost of camera maintenance is set by Faceter in USD and may be revised on a quarterly basis.

Faceter's relations with customers and miners are regulated by a set of smart contracts that guarantee transparency and the fulfillment of all the terms and conditions. **Below are the main points relating to the settlement process in a decentralized network and Faceter token use:**

1   Faceter forms a pool of smart contracts with miners where all the main terms and conditions are stipulated, including leased computing power, remuneration rates, contract duration, etc.

2   Faceter pre-transfers tokens to miners' smart contracts for the subsequent payment of leased services using the system's reserve pool.

3   Service users submit applications to connect their CCTV cameras and make payments using their preferred payment methods. If payment is made without using FACE tokens, instant conversion to tokens will be performed.

4   Smart contracts are also created for customers. These smart contracts stipulate the parameters of purchased services and are used for receiving payments made in tokens.

5   The customer smart contract distributes tokens. The main part of tokens is returned to the system's reserve pool (~60%), a portion goes to Faceter (~20%) as compensation for video obfuscation costs and service support, and the remaining balance **is burned.**

6   The transaction identifier obtained through burning is an access key to the service. It is then broadcast along with all tasks in the decentralized network and can be verified by each participant.

7   The client connects their cameras to the service and starts transmitting video stream. Faceter carries out decoding and obfuscation of all images and passes them to miners for in-depth analysis and the selection of unique vectors of detected objects. Obfuscation is necessary to protect sensitive data. To achieve this goal, the features of convolutional neural networks are used where, after two convolutions, the image is irreversibly distorted and can be safely transferred to other nodes for subsequent convolutions. The whole process of face recognition includes more than 40 convolutions.

8   For each miner, Faceter randomly assigns three other miners who perform the validation of calculations results (re-processing of individual fragments).

9   Once a day, miners pass hashes of processing results to a smart contract. The same action is performed by nodes responsible for validation, following which hashes are reconciled. If they do not coincide, this indicates bad faith of one of the miners, in which case their remuneration is automatically frozen thus initiating an arbitration procedure.

10 Miners independently request payment of fees from their smart contract taking into account the escrow period which takes from 1 to 14 days. During this period funds are held. The duration of the escrow period depends on the miner's ranking and may decrease in the process of work.

11 Minersand other token holders can use FACEs to purchase Faceter services or to sell them through exchanges, as well as to convert tokens to ETH at the time of buy-out (for more details, see Chapter 9.2 "Buy-out Program").

Faceter technologies

Faceter's team also collaborates with other companies developing solutions in the field of Fog Computing and provides an opportunity to connect computing resources from other networks through token exchange mechanisms.

Token circulation in Faceter's system
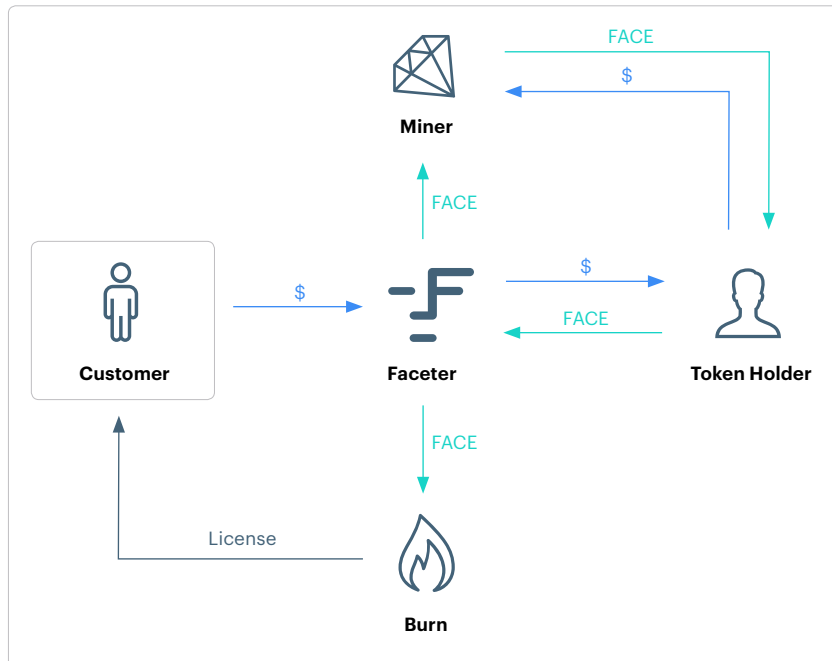
Due to the fact that all product sales, be it a monthly subscription or a license contract, are reflected on the blockchain, all information on the company's business indicators will be publicly available and can be verified by customers (license information is displayed in customers' user accounts) and other participants of the ecosystem, such as node owners that perform image processing.

7.

Business model

Smart Strategy To High Profit

Faceter's business model includes multiple ways of income generation depending on the results of the crowdfunding campaign (see paragraph 9). **Below are listed the key mechanisms of project monetization. In all of them, a portion of profit is supposed to be used to buy out tokens and burn them.**

Fees for processing video
Consumers will be offered a service at $9.99 per month per camera, whereas miners' rewards will not exceed 50% even if such rewards will be twice as high as revenues from Ethereum mining.

Contracts in B2B and B2G sectors
Large corporations and state enterprises are highly interested in such products and are ready to enter into long-term contracts with a monthly fee for each connected camera.

Faceter hardware solutions
Priority is given to close cooperation with suppliers of video surveillance equipment. It is also planned to develop proprietary and co-branded video cameras capable of performing primary video stream processing and its obfuscation on embedded chips optimized for Faceter algorithms.

Paid searches
Faceter users remain unconditional data owners and have full control over access to their data. Camera owners can also take part in activities to search for certain people and get rewards in the form of tokens if such people are discovered. For this purpose, it is planned to develop an additional service with its own set of smart contracts in compliance with legislative norms regulating personal data protection.

8.
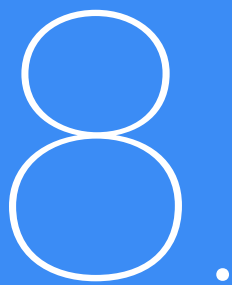
Roadmap

Fulfilling Sci-Fi Predictions

2014 ● The Faceter project was
launched in 2014.

2017 ●

— Alpha version of Faceter for B2B
is released

— Proof-Of-Concept of Faceter
for mass market (centralized version)

2018 ●

Token Sale —

— Building modular architecture and
adapting Faceter to fog computing
networks to reduce computation costs

— Developing Android, iOS, Apple TV
applications

New team members: —
growing IT department

— Developing a module for classifying
individuals in videos to augment the
event-based model with the following
features: sex, age, race, emotions

Launching beta version of Faceter —
running on a fog and starting sales
in the mass market segment

— Adding a "user friendly" option: store
video archives in decentralized IPFS-
based storage providers

2019 ●

— Developing integrated solutions in
collaboration with hardware vendors

— Tracking visitors with partially or
completely hidden faces. Recognizing
body type features: height, weight,
build.

New team members: sales and —
business development specialists

— Vehicle detection and recognition
in video, including recognition
of numbers using cameras with
sufficient resolution

Partnership agreements with video —
camera vendors regarding Faceter
preinstallation

Launching a fully functional —
decentralized version of Faceter

— Developing a technology for detecting
different events in the cameras' scope:
run, fall, fight, unattended items,
hazardous situations (flame, smoke,
vibration, non-standard noise etc.)

9.

Token Sale

Great Opportunity To Contribute

To achieve all the goals stated in the roadmap with regard to the development of the Faceter product, the team launches a crowdfunding campaign based on the Token Sale model.

Faceter plans to issue a certain number of tokens some of which will be distributed as part of the crowdfunding campaign.
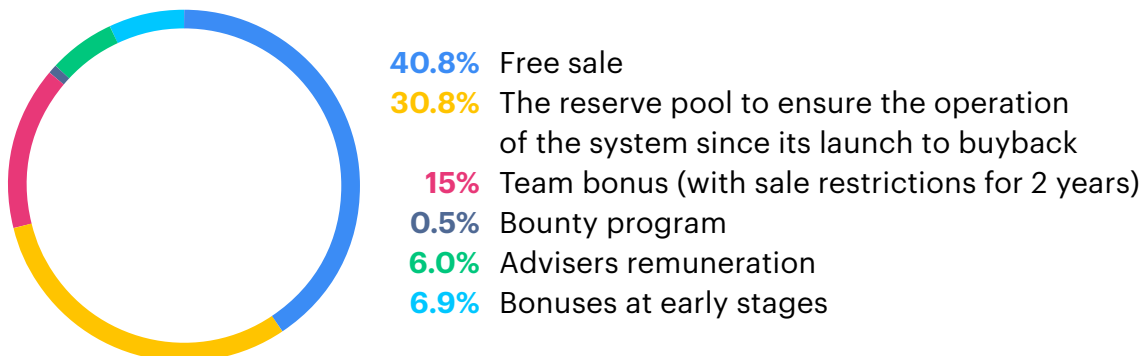
Participants in the Faceter token sale in return for their contributions receive FACE tokens. The distribution of FACE tokens will be subject to and governed by a separate document setting out the terms and conditions of the agreement as between Faceter and each token sale participant.

Tokens will be issued on the Ethereum platform in accordance with the ERC20 standard.

Token Ticker: **FACE**	**Quantity:** **1,000,000,000**	**Nominal price:** **$0.1 in ETH**	Additional emission is not planned.

FACE token is used as the local instrument of payment on the Faceter platform and is a key element of the business model.

9.1   Token distribution

40.8% Free sale
30.8% The reserve pool to ensure the operation of the system since its launch to buyback
15% Team bonus (with sale restrictions for 2 years)
0.5% Bounty program
6.0% Advisers remuneration
6.9% Bonuses at early stages

Public token sale is planned to be executed in two stages: Presale and Token Sale.

Presale: (February 1, 2018 – March 1, 2018)
Tokens to sell: 8,000,000 FACE (equivalent to $800,000)
Bonus program: 50%

Token Sale* (March 10, 2018 – April 30, 2018**)
Tokens to sell: 400,000,000 FACE (soft cap $5,000,000)
Bonus program: no more than 6,4% of tokens from total emissions will be allocated to token sale participants at all the stages. Detailed information on the distribution of bonuses will be published on tokensale.faceter.io no later than 2 weeks before the token sale.

Extra 5% bonus for individual purchases greater than $10,000.

*   All tokens that will not be sold during the token sale will be burned.
** The main token sale maybe launched earlier if presale is closed by reaching it's hard cap.

After the crowdfunding campaign is finished, FACE tokens will be traded on cryptocurrency exchanges.

Free token circulation will enable users to buy tokens thus gaining access to Faceter services, as well as to sell them to other ecosystem participants.

9.2   Buy-out program

After Faceter starts making a profit, we will allocate 20% of our revenues to buy out FACE tokens to replenish the reserve pool on a quarterly basis. The buy-out price will be based on the market value of FACE token, but not below its nominal value.

FACE token buy-out mechanism:

1. Based on quarterly results, 20% of the company's revenue will be allocated to the token buy-out pull. Preparatory measures before the start of the buyout procedure will take about one month.

2. Faceter issues a smart contract to purchase tokens with a fixed amount and a fixed closing date.

3. Faceter users will be informed of the opportunity to sell their tokens.

4. Token holders will be able to send their tokens for sale until the critical point is reached – an amount covering the buy-out of a certain number of tokens defined b y the smart contract.

5. Token holders will be able to send and revoke their tokens prior to the closing date of the smart contract. After the closing date, the number of tokens will be fixed and all participants will be sent funds in proportion to the number of tokens remaining on the contract.
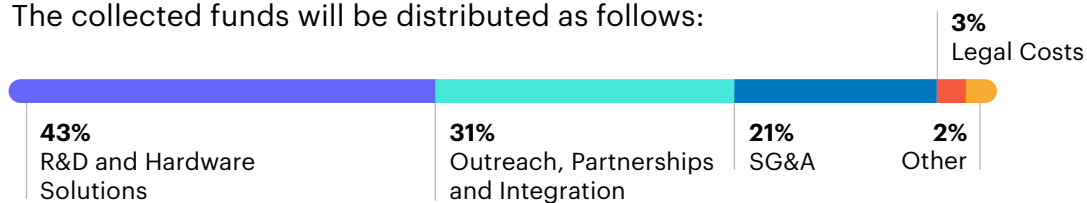
9.3   Scenarios for the use of raised funds

Funds received through the crowdfunding campaign will be used in accordance with the Roadmap. At the same time, the number of features implemented on the platform will depend on the amount of funds raised. The implementation of all the declared features will be possible if the project collects the maximum amount of funds (Hard Cap). Faceter should be considered as an R&D project in the field of the latest (bleeding-edge) technologies. The team confirms the plans declared; however, their implementation depends on the results of the crowdfunding campaign. The project's business and financial model provides for the proportional demand for the final product with some extra functions. Below is a table with three possible scenarios depending on the amount of funds collected:

Token Sale

	Core Features	Infrastructure	Hardware
Minimum Financing ($5 000 000)	Recognizing people by their faces Sex, age, race and nationality recognition Recognizing body type features: height, weight, build Recognizing emotions Pet recognition	Development of a decentralized computing architecture adapted to SONM, Golem, etc Storage of video archive Mobile apps for iOS and Android	
Medium Financing ($20 000 000)	Recognizing people with partially or completely hidden faces Development of a teachable active event-based security model Speech and sound recognition Identification of people on terrorist lists	Development of proprietary decentralized network Open API for integration	Integration into the equipment provided by suppliers of video surveillance systems
Maximum Financing ($40 000 000)	Detection and classification of cars, including recognition of numbers on cameras with sufficient resolution Identifying people by their profiles on social networks	Development of proprietary blockchain Global people search system with a reward program	Release of proprietary video recorders and cameras Integration with suppliers of smart home systems Solution powered by augmented reality technologies for employees of security services (HoloLens version)

The collected funds will be distributed as follows:

3%
Legal Costs

43%
R&D and Hardware Solutions

31%
Outreach, Partnerships and Integration

21%
SG&A

2%
Other

* Depending on the amount of funds raised, the distribution of costs between R&D and marketing may vary by 5%.

10.

Our team

Professionals, Leaders, AI-Enthusiasts

Faceter is an international team with extensive experience in research and development in the field of computer vision and biometrics, as well as in high-tech international business development.

Igor Karavaev
Advisor

Investor relations advisor of blockchain projects, top expert at ICObench. Ex-executive Director at the Skolkovo Foundation, the leading Russian business incubator of hi-tech start-ups. Before worked as a head of strategy, investments and business development of the largest international corporations.

Robert Pothier
CEO, Co-founder

Managed and Directed operations with 9 years of global experience in the payment technologies industry. Consulted and lead various mobile and kiosk technologies. Presented and represented some of the largest payment solutions companies in the world (Pinnacle Micro, Walletone.com, etc.); on e-wallets, gambling, KYC, various banking solutions and scanning technology in the United Kingdom, Spain, Italy and several African countries.

Paul Scott
Business Development (CBDO)

Paul is a seasoned professional in financial markets and emerging-market technologies. He has deep-level FinTech, InsurTech and Big Data ecosystem knowledge, including utilisation of leading-edge technologies that underpin the ecosystem's development. His focus for the last 2-years has become the inherent benefits in Blockchain technology and the nascent opportunities this presents for a decentralised global economy.

Jayson Gouws
Solutions and Distribution

Security Technology Specialist with more than 20 years experience, head of Faceter Distribution Team. Jayson has completed a number of large scale projects, such as

state and city level integrated security solutions. He also has extensive experience in providing holistic middle scale security technology solutions in the following sectors: Retail Shopping Centers and Retailers, Commercial, Industrial, Public Safety and Recreation Facilities. Jayson has a reputable understanding of the market and a clear vision of both global & local distribution channels.

Vladimir Tchernitski
CTO, Co-founder, ML-master

Has more than 25 years of experience in software development. Before Faceter he was the head of R&D-department of international outsource software development company, where he started to work with convolutional neural networks, more than 4 years ago. The current Faceter's team, by guidance of Vladimir, has already developed a successful product – opensource library pay.cards for banking cards data recognition, which became very popular among mobile application developers worldwide and was downloaded more than 25 000 times.

Aleksandr Chernov
Tech Lead

An expert in full-stack administration, as well as front-end and backend programming. A professional in product design and analytics. Worked as a system analyst and a team leader in walletone.com, taaasty.com, bananastreet.ru and other projects; Took on the projects in a technologically outdated state, restarted them together with the new team, developed new monetization mechanisms, initiated several stages of redesign.
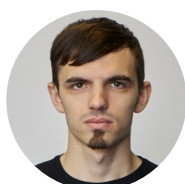
Vitaliy Kuzmenko
Mobile Development

Five years' experience in team management and iOS development. An expert in the field of UI. Works with such programming languages as Objective-C, Swift, PHP, HTML, CSS, and JavaScript. Participated in wallet. one, pay.cards, taaasty.com, and siberian.pro projects.

Anton Ivashkevich
Design

Eight years' experience in the field of product design. Specialization: adaptive web and mobile interfaces, iOS / Android applications, design, concept development. Worked as a lead designer for projects with multimillion audience (Viber wallet), Walletone.com, pay.cards, or71.ru, taaasty.com, thelocals.ru, catery.ru.

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Dig Deep And Enjoy

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faceter.io

Computer vision surveillance
technology powered by fog
network of miners