



“to understand people and predict their behaviour to advance human potential.”

NVISO is a leader in human behaviour artificial intelligence (AI) software for the extreme edge, serving manufacturers of user-centric products and services worldwide.

We combine advanced AI and machine learning with cutting edge science to decipher complex human behavior from multiple sensors using an holistic approach and enable safe, secure, and personalized interactions with autonomous systems

Confidential and Private

NVISO SA (**NVISO**)



30th November 2022

18.51	16.01
15.01	14.05
14.05	14.05
14.05	14.05

Company Profile

Company | Overview

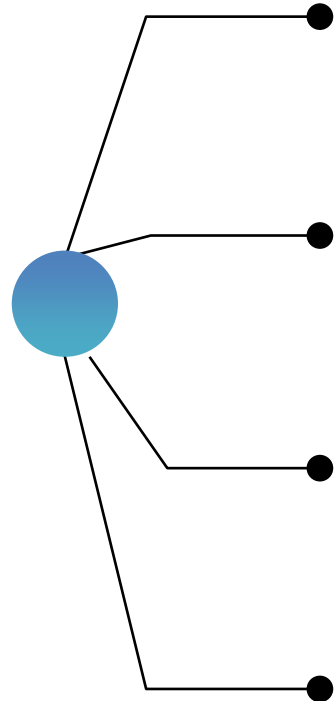
- Core Expertise and Markets
- Product and Market
- Company Overview and Status

NVISO **CORE EXPERTISE** | **Complex Emotions** and Predicting Behaviour

Decades of Experience in Human Behaviour Artificial Intelligence at the Deep Edge



Humanizing Autonomous Machines with Safe, Secure, and Engaging Experiences.



DEEP EDGE AI (EMBEDDING AND INTEGRATION)

Deep Edge AI is a combination of Edge Computing and Artificial Intelligence. AI algorithms are processed locally, directly on the device, without the need for an internet connection or sending or storing any personal data off device. This is critical for applications such as cars, robots, or medical devices.



SEMANTIC REASONING (HUMAN FACTORS)

Semantic Reasoning is the ability of a system "to make logical deductions from the information that is explicitly available". A human knowledge graph and semantic reasoning engine, derives new data from perception and observational data that it is explicitly given, using ontologies and rules.



COMPUTER VISION (PERCEPTION AI)

Computer Vision is an Artificial Intelligence (AI) field dealing with how computers can obtain high-level understanding from digital images and videos. AI algorithms analyze images to detect objects, categorize images, identify objects, and add metadata.



HUMAN BEHAVIOUR RESEARCH AND DATA

Data is the lifeblood of AI. An AI system needs to learn from data in order to be able to fulfill its function. NVISO has collected over 1Billion data points of human behaviour from large image and video datasets applicable to multiple industries.

NVISO **CORE PEOPLE** | Experienced Management Team with Global Presence

Well positioned to deliver on the significant growth opportunity

HQ, EPFL,
Switzerland



Sales Office,
Yokohama, Japan



Tim Llewellynn

Executive Director,
CEO & Co-Founder

- Tim is an international entrepreneur with 20+ years experience growing high growth tech ventures from startups to fortune 500 companies working across sales, marketing, and product development. Tim co-founded NVISO in 2011 and holds a Masters and Bachelor Honours from the University of Canterbury, New Zealand in Electrical and Electronic Engineering.



David Tolub

Commercial Strategy

David brings to 20+ years of experience in managing R&D, Marketing and Sales at high tech companies. Prior to joining NVISO, David was CEO at CIPAI, Oversi, and Vice President and General Manager of the Mobile Handset Vendor Division for SanDisk. He managed the divisions' worldwide activities and its fast growth to revenue of over \$200M. Mr. Tolub earned his MBA from Boston University. He also holds an MSc of Electrical Engineering from the Technion University, Haifa, Israel.



Bogdan Lazar

Head of Products

- Bogdan has more than 13+ years of experience in project management (hardware and software, new products, each multi-disciplinary), building and managing engineering teams. Bogdan holds a PhD in Manufacturing Systems and Robotics from the Swiss Federal Institute of Technology (EPFL) / Laboratory of Computer-Aided Design and production (LICP)



Colin Mason

Head of Sales / COO

- Colin is an international technology professional with nearly 40 years management, sales, marketing, engineering and operations experience. Colin holds a Bachelor of Science (Electrical and Electronic Engineering) with Honours from The University of Edinburgh, is a Chartered Engineer and a Member of the Institute of Engineering and Technology.



Takahiro Nakamura

Sales Manager (Japan)

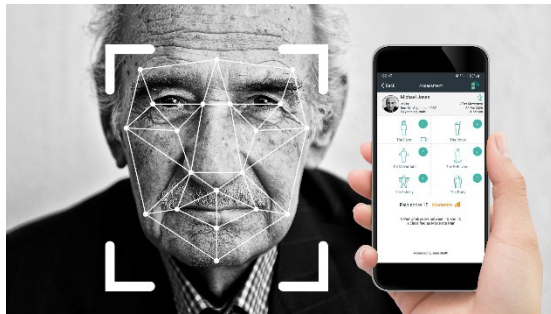
- Takahiro has more than 30 years of sales experience in the Japanese market. Takahiro has held several director level sales positions with major Japanese. Takahiro holds a Bachelors of Physics from the College of Science and Technology, Nihon University



Group Holding,
Australia

NVISO **CORE MARKETS** | Where Human Behaviour AI is Mission Critical

From autonomous systems, understanding non-verbal communication, to new human-robot interactions



Healthcare /
Medical Equipment



Avatars / Gaming /
Communications /
Consumer Robotics



Automotive and ADAS
/ Telematics / Mobility-
as-a-Service

NVISO's UNIQUE **HOLISTIC PREDICTIVE** APPROACH

Sense

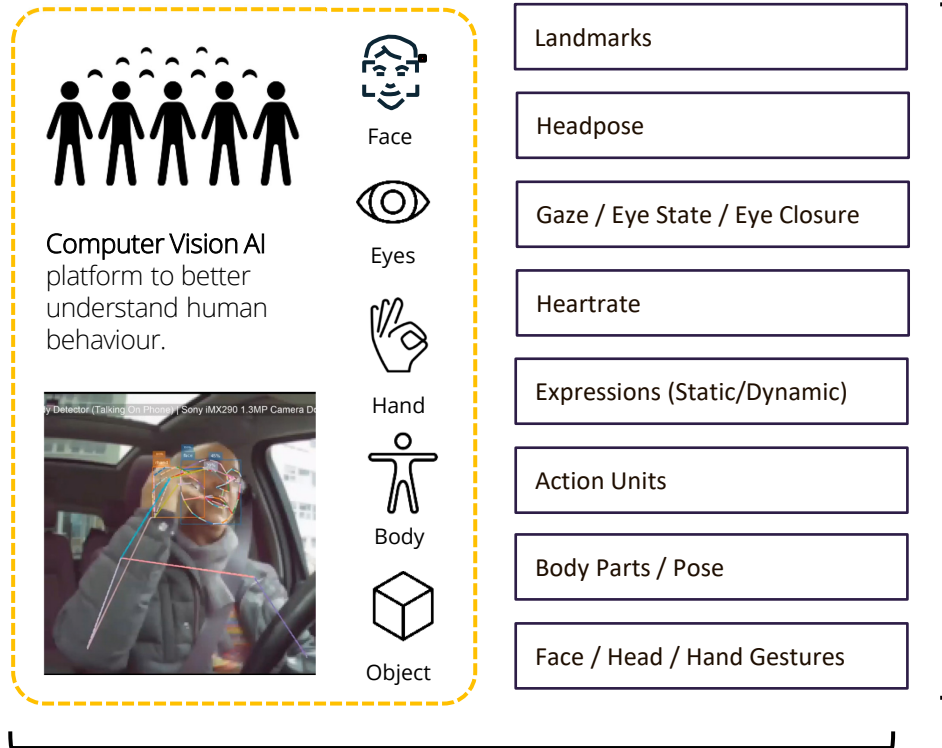
Predict

Act



Any Camera

Any commodity camera found in devices.



Multiple Signals



Holistic Prediction



Complex Emotion Prediction

Other Sensor Signals

Context



Real-time decisions



High robustness



High accuracy

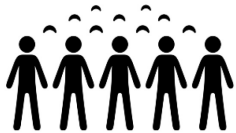


Pre-emptive vs reactive

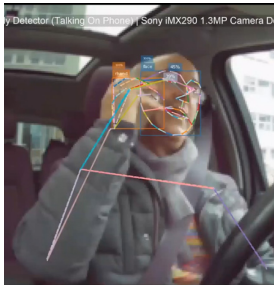


Detections (Core Perception AI)

- RGB/NIR/ToF
- Non-visual



Computer Vision AI platform to better understand human behaviour.



Face



Eyes



Hand



Body



Object

Hardware
(Specialised AI Hardware)



Observations (Observational AI)

Landmarks

Head Pose

Gaze / Eye Closure

Heart rate

Facial Expressions

Action Units

Body Parts / Pose

Gestures

Observation API

Partners
(Specialist Features)



Predictions (Advanced Emotions Level)

Your custom signal

Complex Emotions
(Fatigue, (Dis)Comfort/Pain, Stress)

Advanced Emotions
(While Talking, Anxiety, Confusion)

Health and Vital Signs
(Heart, breathing rates)

Demographics and Biometrics
(Face ID, Age, Gender)

Intention Prediction
(Intention, object usage)

Activity Prediction
(Out of position, activities)

Advanced Gaze (optional)
(3D, AOI, distraction, drowsiness)

Advanced Body Pose (optional)
(3D, movement, orientation)

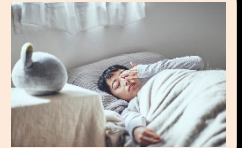
Prediction API



Applications (Use Cases)

Robotics

Emphatic Human-Machine Interaction



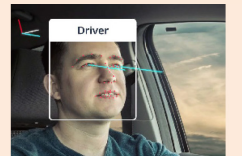
Health

Improve diagnostics, remote access to health care and optimized workflows



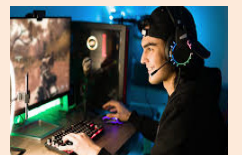
Mobility

Next generation DMS/OMS with Predictive functions and Human-Machine Interactions



Gaming

Adaptive gaming features based on advanced emotional states



New Human-Robot INTERACTIONS

PANASONIC NICOBO: COMPANION ROBOT

NVISO AI Platform is supporting the interaction of companion robots with their owners in their daily lives. It detects presence and identity of the owners, anticipating and reacting to their attention by tracking head pose, gaze. The robot can also appropriately adjust its reactions to the owners mood by understanding their facial expressions. Over-the-air update allows the deployment of new and innovative AI fuelled features.

AI App Catalog



Face



Hand



Eyes



Body



Animal

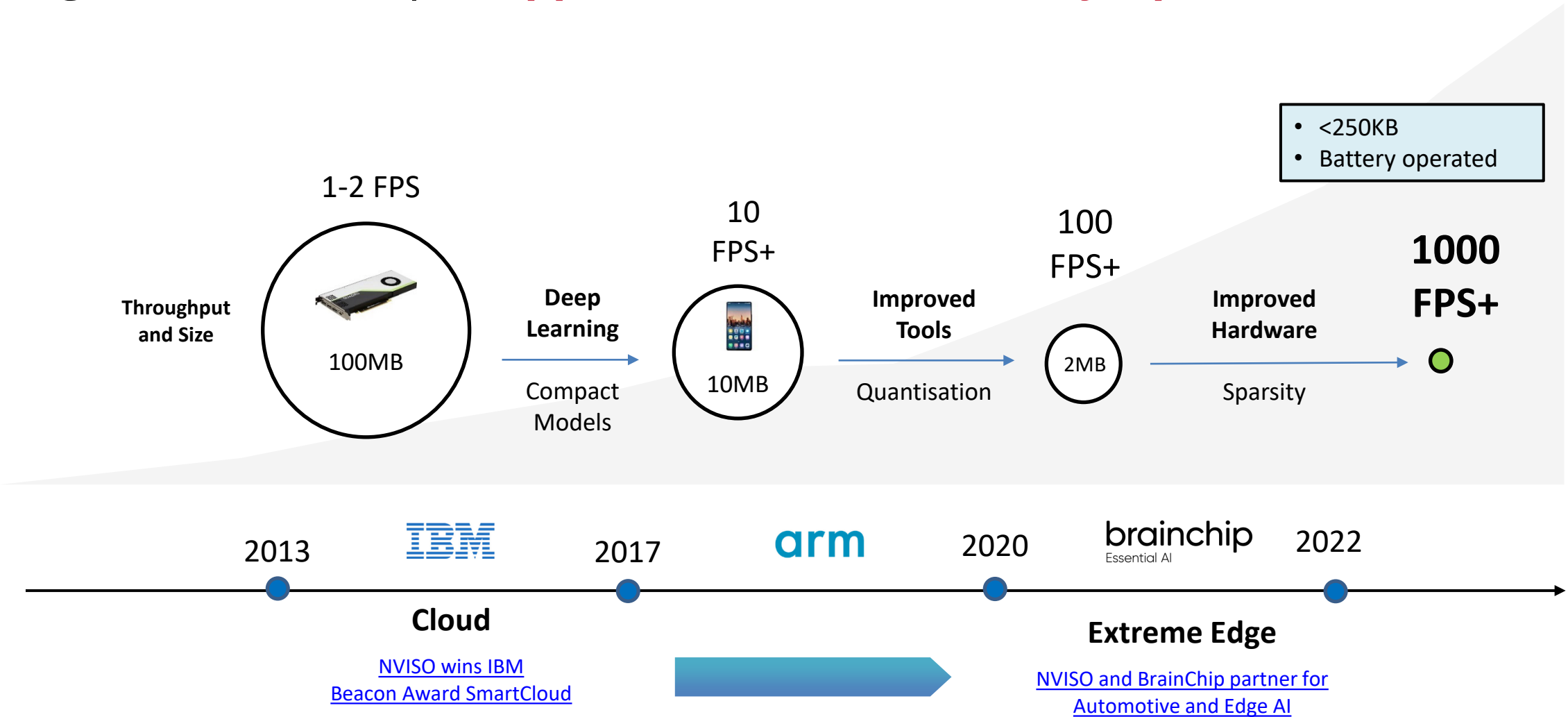


Object



Interactive Systems supporting daily life with safer, personalised, and mood-sensitive experiences

Edge AI Transition | AI Apps From Cloud to Battery Operated Solution



NVISO Present Clients

COMPANION ROBOTS

Social robots to help reduce loneliness and increase independence in people living at home alone, especially with the elderly.



IoT

1 FPS

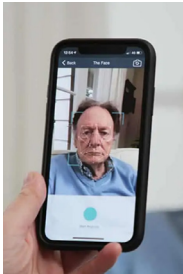


NXP

Low power edge computing platform with camera attached to device.

HEALTH ASSESSMENT

The aged care sector is in desperate need of technological solutions to support the care of the elderly and particularly those living with dementia.



Mobile

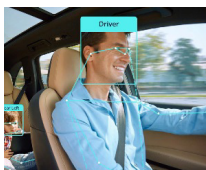
20 FPS



Phone or tablet with embedded camera in screen with restricted placement.

DRIVER AND OCCUPANT MONITORING

Next generation mobility requires AI for interior sensing for safety, security, and experience.



HPC

30 - 60 FPS



NVIDIA

High power edge computing platform supporting attached cameras or non-attached cameras.

Camera or Video Input



Industry Applications

Customer Requirements

NVISO

Solutions

SDKS

Certified Platform

Certified Device

Tools



Standard Signal Definitions

Platforms

Supported Hardware

Clients

Panasonic

HONDA
INNOVATIONS

PainChek
Intelligent Pain Assessment

SIEMENS
Healthineers



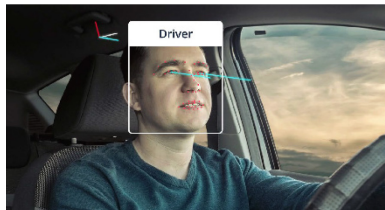
Robot

Health

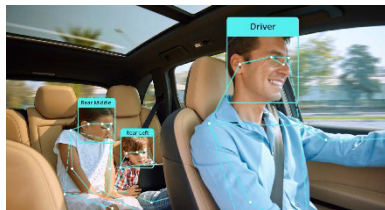
Interior Sensing

NVISO Product Demo

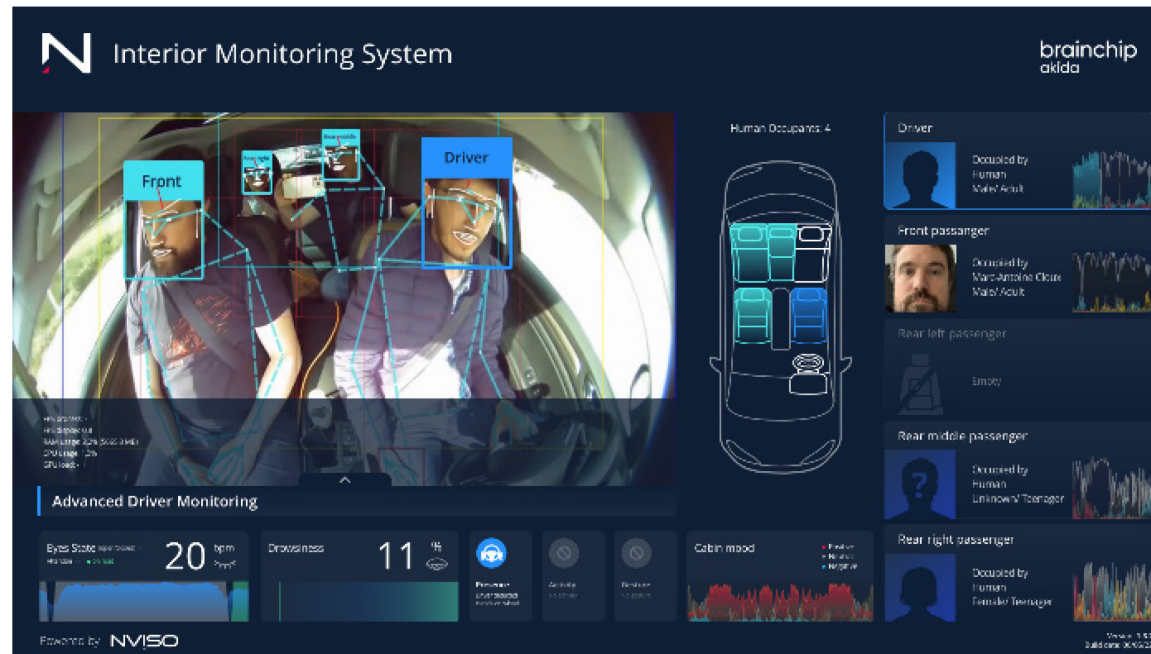
Interior Monitoring Systems for Mobility



DRIVER MONITORING
SAFETY



OCCUPANT DETECTION
SECURITY



- **Test Vehicle** in Switzerland equipped with 20+ AI Apps running on Intel x86, NVIDIA Jetson Xavier AGX, NVIDIA Jetson Nano, and NXP iMX8 QuadMax hardware platforms.
- **NVISO Emotion and Headpose AI Apps** optimized BrainChip Akida hardware
- Designed for DMS/IMS applications for connected and L2+ cars

Watch online - <https://vimeo.com/manage/videos/707615293/0e30484724>

Intellectual Property | Patent Granted

US Patent for Human Behavioural Profiling from Image Processing using Artificial Intelligence by the US Patent and Trademark Office (patent number US 11,048,921) on 29 June 2021

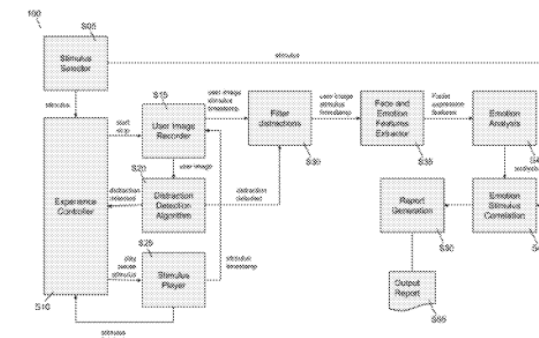
<https://patents.google.com/patent/US11048921B2/en?q=US+11%2c048%2c921>

Continuation patent application with the Serial No. 16/403,656 filed 26th June 2021

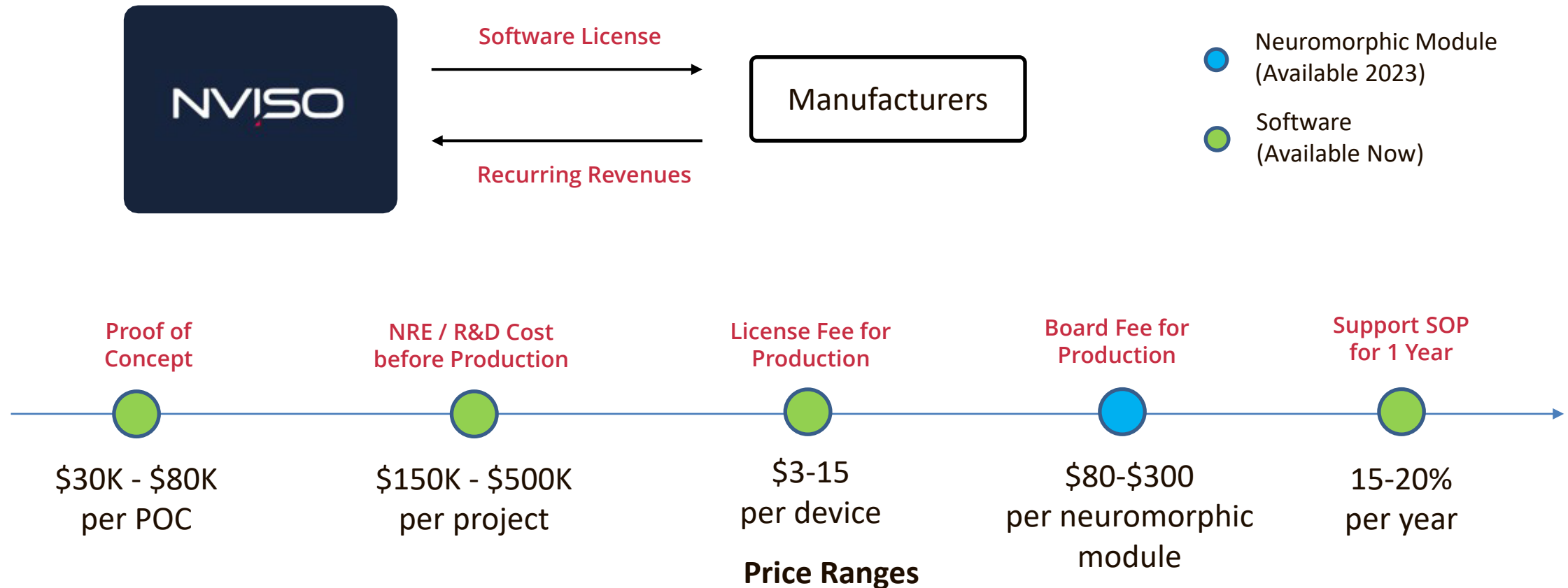
Applications extended to automotive, healthcare, and robotics.



(12) United States Patent Sorci et al.		(10) Patent No.: US 11,048,921 B2
		(45) Date of Patent: Jun. 29, 2021
(54) IMAGE PROCESSING SYSTEM FOR EXTRACTING A BEHAVIORAL PROFILE FROM IMAGES OF AN INDIVIDUAL SPECIFIC TO AN EVENT		(56) References Cited
(71) Applicant: nViso SA, Lausanne (CH)		U.S. PATENT DOCUMENTS
(72) Inventors: Matteo Sorci, Morges (CH); Timothy Llewellynn, Saint-Prex (CH)		5,905,807 A 5/1999 Kado et al.
(73) Assignee: nViso SA, Lausanne (CH)		6,526,161 B1 2/2003 Yan
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 72 days.		(Continued)
(21) Appl. No.: 16/403,656		FOREIGN PATENT DOCUMENTS
(22) Filed: May 6, 2019		WO WO 1/2016
(65) Prior Publication Data US 2019/0347478 A1 Nov. 14, 2019		PCT/US2016/015181
Related U.S. Application Data		OTHER PUBLICATIONS
(60) Provisional application No. 62/668,856, filed on May 9, 2018.		David C. Howell, "Statistics in Psychology," 8th Edition, University of Vermont, Wadsworth Cengage Learning Publication, 2013, ISBN-13 978-1-111-83548-4—Abstract.
(51) Int. CL G06K 9/00 (2006.01) G06N 3/08 (2006.01) (Continued)		(Continued)
(52) U.S. CL CPC G06K 9/00335 (2013.01); G06K 9/00671 (2013.01); G06K 9/6267 (2013.01); G06N 3/08 (2013.01); G06Q 40/08 (2013.01)		<i>Primary Examiner</i> — Brenda C Bernardi (74) <i>Attorney, Agent, or Firm</i> — Andre Roland S.A.; Nikolaus Schibli
(58) Field of Classification Search CPC G06K 9/627 ; G06K 9/00671 ; G06K 9/00335 ; G06K 9/00302 ; G06K 9/4628 ; (Continued)		(57) ABSTRACT An automated method for assessing a behavioral profile of an individual based on image processing, the behavior profile being specific to a hypothetical or actual event, the method including the steps of detecting non-verbal communication from a physiognomical expression of the individual based on image data by a first computer algorithm, the image data being created by exposing the individual to a stimulus and obtaining the physiognomical expression of the individual in response to the stimulus, correlating features of the non-verbal communication to a topical area by a second computer algorithm, and generating a report corresponding to the individual that reflects the correlation between the non-verbal communication and the topical area, the report including the behavior profile of the individual.
		19 Claims, 17 Drawing Sheets



Business Model | Recurring License Revenues



Competition | From Detection to Prediction

From Single Sensor to Holistic Approach

Universal Detection

AI algorithms are processed locally, directly on the device, without the need for an internet connection or sending information to the cloud. They work across the globe and cultures.

Real-time Prediction

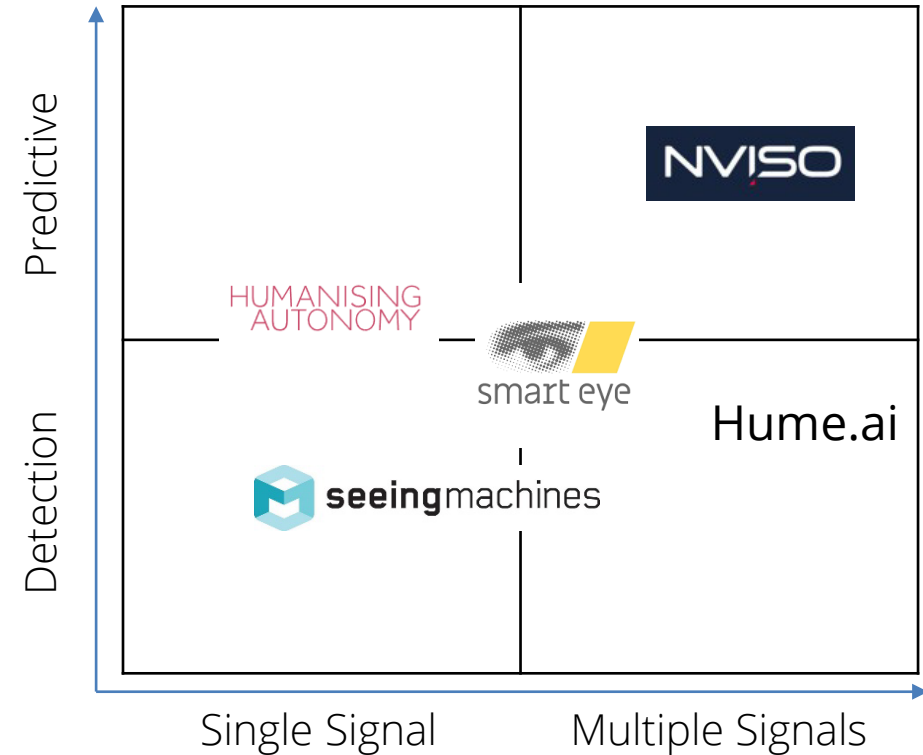
Through analyzing thousands of datapoints per image, complex emotions and human behavioral states can be predicted over short and long durations.

Multiple Signals Integration

Through the integration of multiple signals, system robustness and confidence can be improved, especially in difficult corner cases.

Pre-emptive vs Reactive Systems

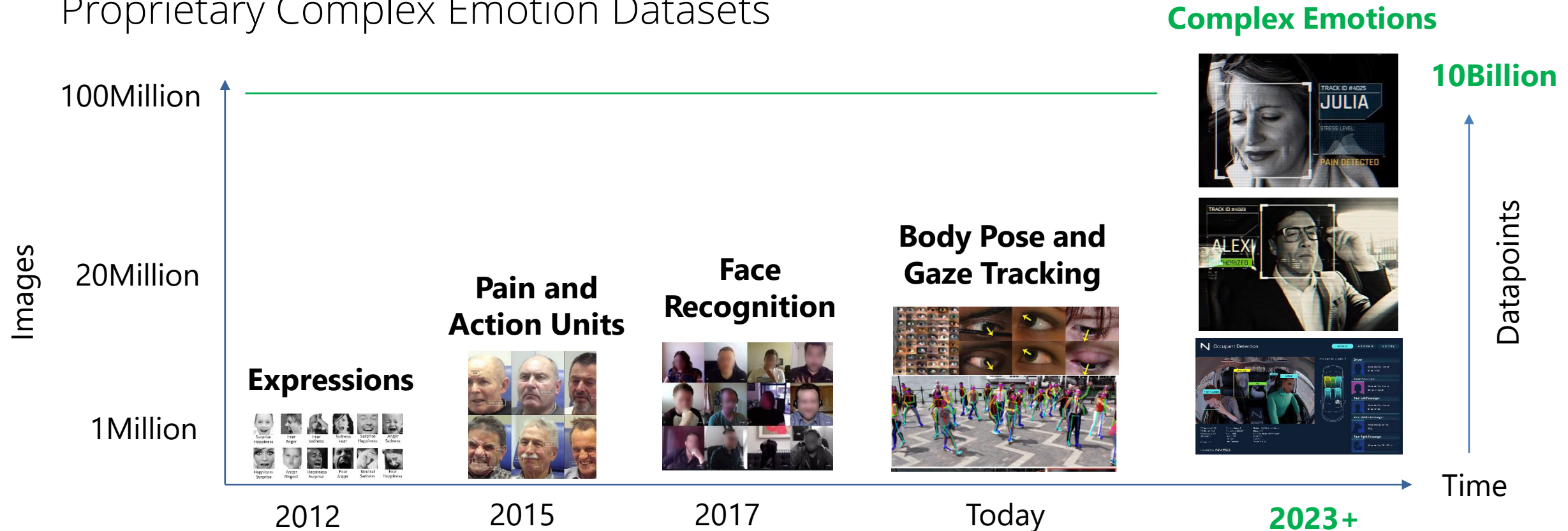
Systems using NVISO holistic predictions can become pre-emptive opposed to simply reactive. Enable new, intuitive, and engaging user experiences.



Faster and more robust decisions based on detection process (pre-emptive vs reactive)

Barriers To Entry | Unique Holistic Multi-Sensor Databases

Proprietary Complex Emotion Datasets



Large and diverse multi-sensor Human Behavior AI datasets creates increasing barriers to entry

Company Profile

AI Solutions | Automotive Interior Monitoring Systems

Driver Monitoring and Interior Sensing

Key Technical Challenges for Software



Frame Rates and Camera Location

Driver-related detection tasks will have a variable framerate from 30 to 60 fps and degradation phases can be expected with a single stream where frames are not equidistant. Camera location can be varied inside cabin.

Auto-calibration and Mirror Rotation

The angle of the camera changes with each movement of the interior mirror. Therefore, an auto-calibration to estimate the mirror position and rotation must be provided. Relevant CAD data is provided by OEM.

Requirements for Functional Safety

Parts of the recognition data is used for ASIL-B classified functions. Relevant development guidelines need to be considered including ASIL B error detection.

Key technical challenges to overcome: camera, movements, and functional safety

Driver Monitoring and Interior Sensing | Applications of Tomorrow

Future in-car experience to be centered around the driver-vehicle relationship

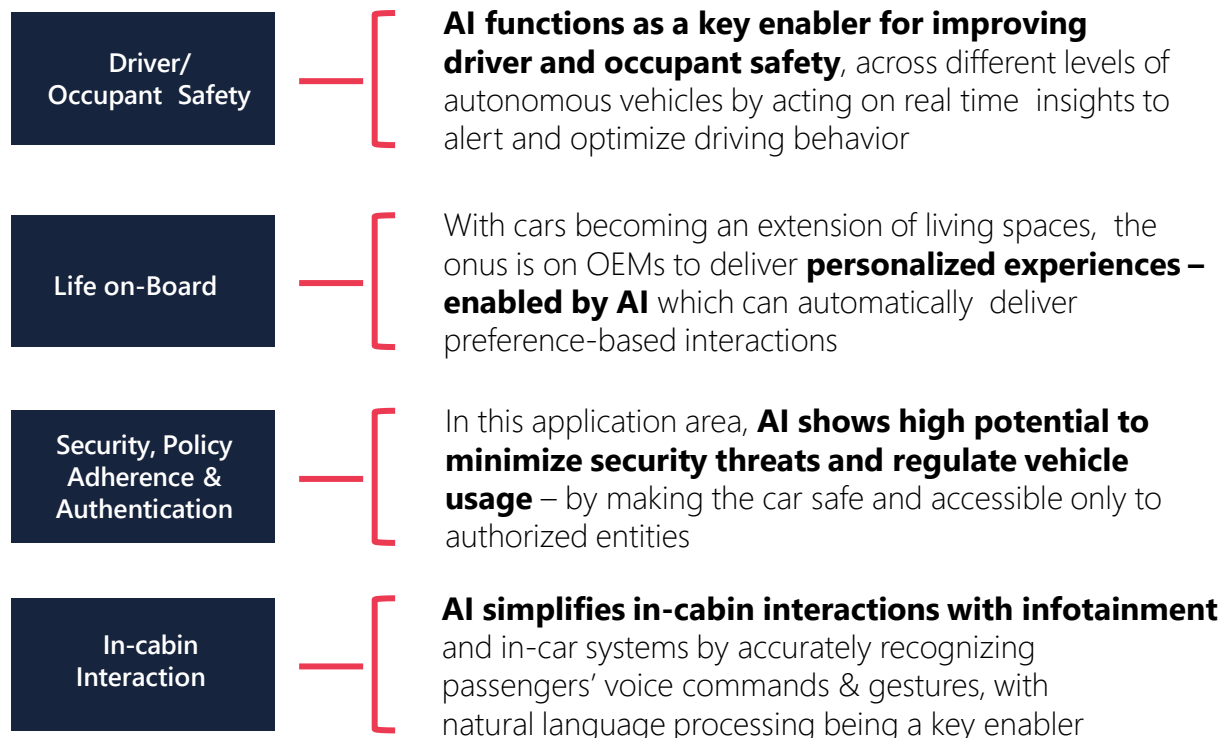
AI enables the car to have continuous learning, with the end goal to develop an understanding with the occupants that is both meaningful and human in nature.

Stakeholders including OEMs and Tier 1s are looking at multi-modal interior sensing solutions using an AI based sensor fusion approach to add context to measured data.

Impact on autonomous cars and shared mobility economy includes enhanced user experience via natural interactions, preferences alignment, and ensure controlled access.

Low market maturity with most initiatives still in the pilot phase, with incremental functionalities being constantly enabled, combined with conceiving new use cases

Software development is a key challenge since the creation, training, and validation of AI algorithms come up against many technical and regulatory obstacles



Beyond regulation, Human Behaviour AI to be key enabler for future in-car experience

Driver Monitoring and Interior Sensing | Key Market Drivers

Automation Technology and Regulation and Strong Secular Tailwinds



REGULATION

LEVEL 2+ and AUTONOMY

Monitoring of the driver is proposed by NCAP as a requirement from 2022, to mitigate the very significant problems of driver distraction and impairment through alcohol, fatigue, etc.



EXPERIENCE

COCKPIT DESIGN AND EVOLUTION

Vehicle autonomy (L3+) will allow various support systems to be implemented for security, safety and comfort and new UX experiences.



MOBILITY AS A SERVICE

CAR AND RIDE SHARING

Car sharing required by societal changes and infrastructure limitations and enabled by vehicle autonomy will shift focus from driving experiences to transportation experiences.

Although regulation is only part of the story, **automation technology is a strong secular tailwind**

Driver Monitoring and Interior Sensing | NVISO LoB Platform Approach

Detections (Core Perception AI)



Observations (Observational AI)



Predictions (Advanced Features)

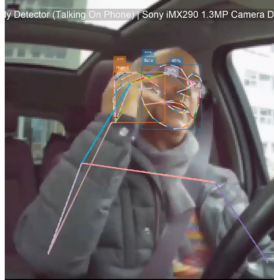


Reasoning and Semantics (Logical Layer)



CAMERA SUPPORT

- RGB
- NIR
- ToF



NVISO Neuro SDK
unique holistic platform
to better understand
human behaviour.



Face



Eyes



Hand



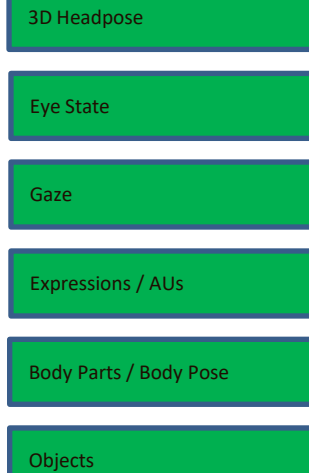
Emotion



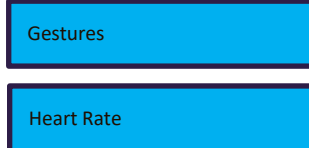
Object



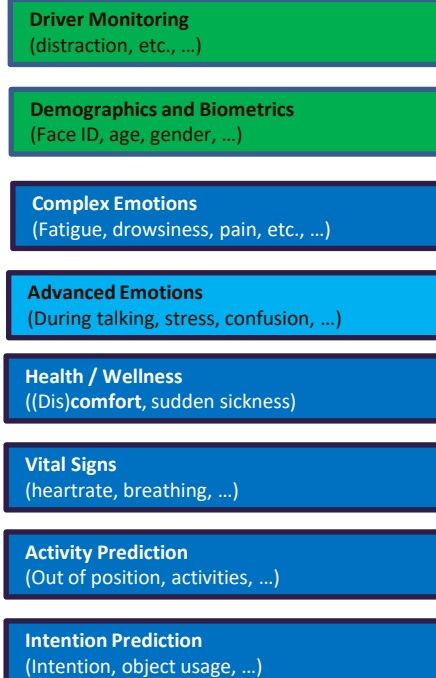
Body



Observation API

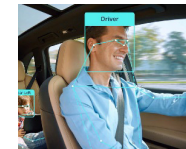


Prediction API



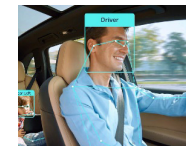
OEM Feature-Level Components

DMS 1.0



Entry Level
NCAP DMS

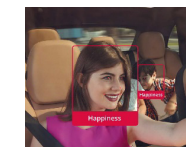
DMS 2.0



Advanced
DMS

Predictive DMS
(Unique on the Market)

Predictive Interior



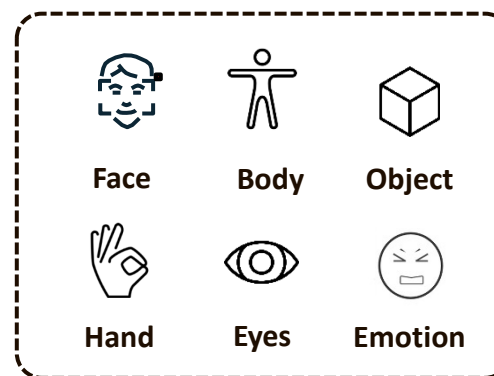
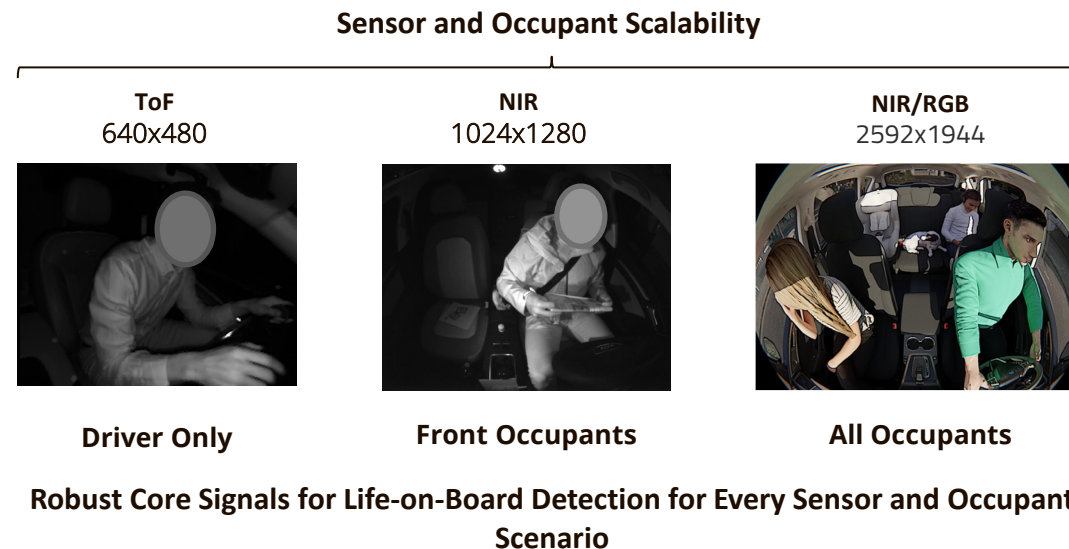
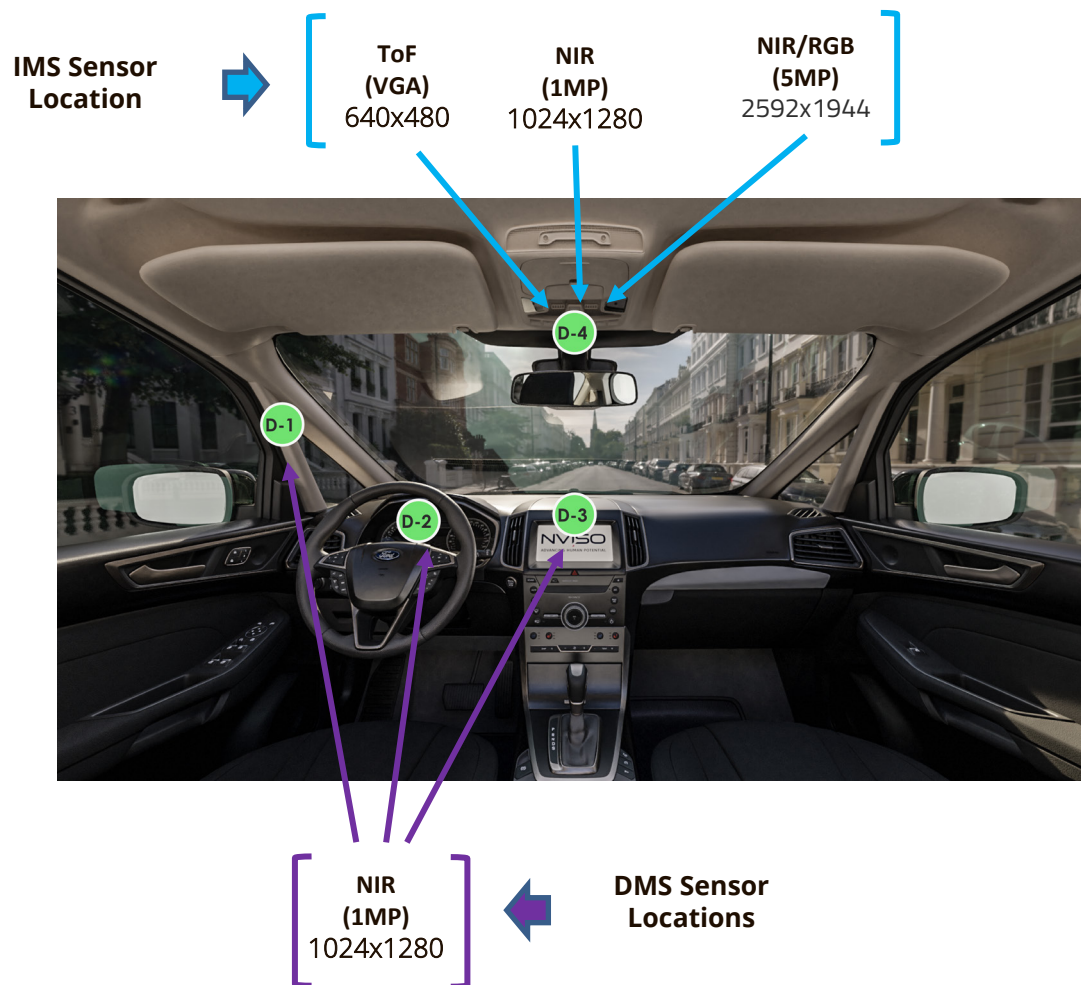
Predictive
Interior
Sensing

Available

In Prototype

In Development

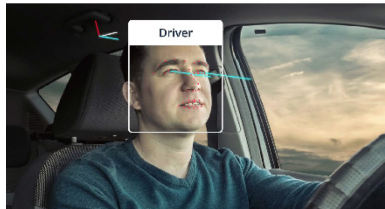
Driver Monitoring and Interior Sensing | NVISO Life-on-Board (LoB) Sensors



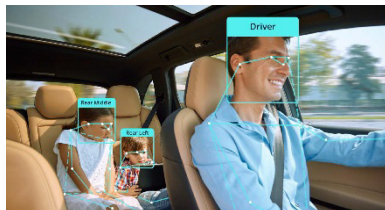
DMS/OMS/CPD for Every OEM Situation

Scalable -> Cost Effective

Driver Monitoring and Interior Sensing | Integration Demo



DRIVER MONITORING
SAFETY



OCCUPANT DETECTION
SECURITY



- **Test Vehicle** in Switzerland equipped with 20+ AI Apps running on Intel x86, NVIDIA Jetson Xavier AGX, NVIDIA Jetson Nano, and NXP iMX8 QuadMax hardware platforms.
- **NVISO Emotion and Headpose AI Apps** optimized BrainChip Akida hardware
- Designed for DMS/IMS applications for connected and L2+ cars

Interior monitoring systems <https://vimeo.com/manage/videos/707615293/0e30484724>



Occupant Count: 1



Cabin Mood

Signal not available

- Happiness
- Surprise
- Sadness
- Disgust
- Anger
- Fear
- Neutrality

Display FPS:
RAM usage: 1.2% (3079.2 MB)
CPU load: 4.0%
GPU load: -

Driver State

Eyes State (open/closed)

Attention:

0 bpm

Vital Signs

Signal not available

0 bpm



Hands on wheel
No hands



Activity



Gesture

Driver



Empty

Front passenger



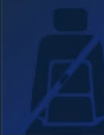
Empty

Rear left passenger



Occupied by
Human
Unknown / Adult

Rear middle passenger



Empty

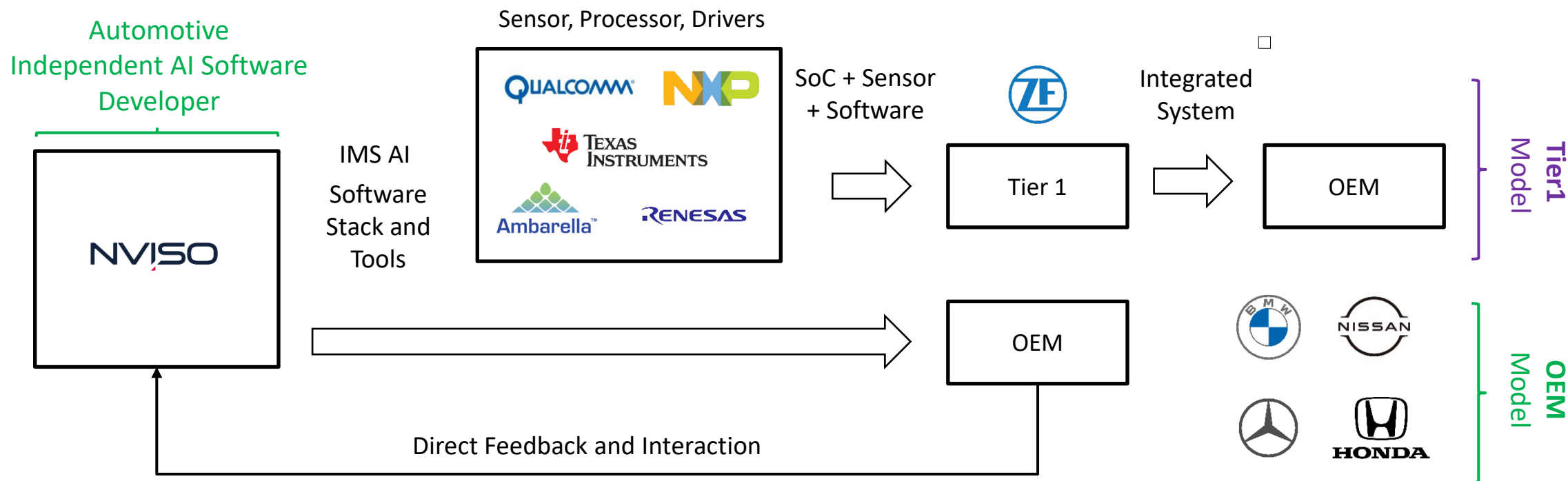
Rear right passenger



Empty

Accelerated Market Opportunity via Platform Approach

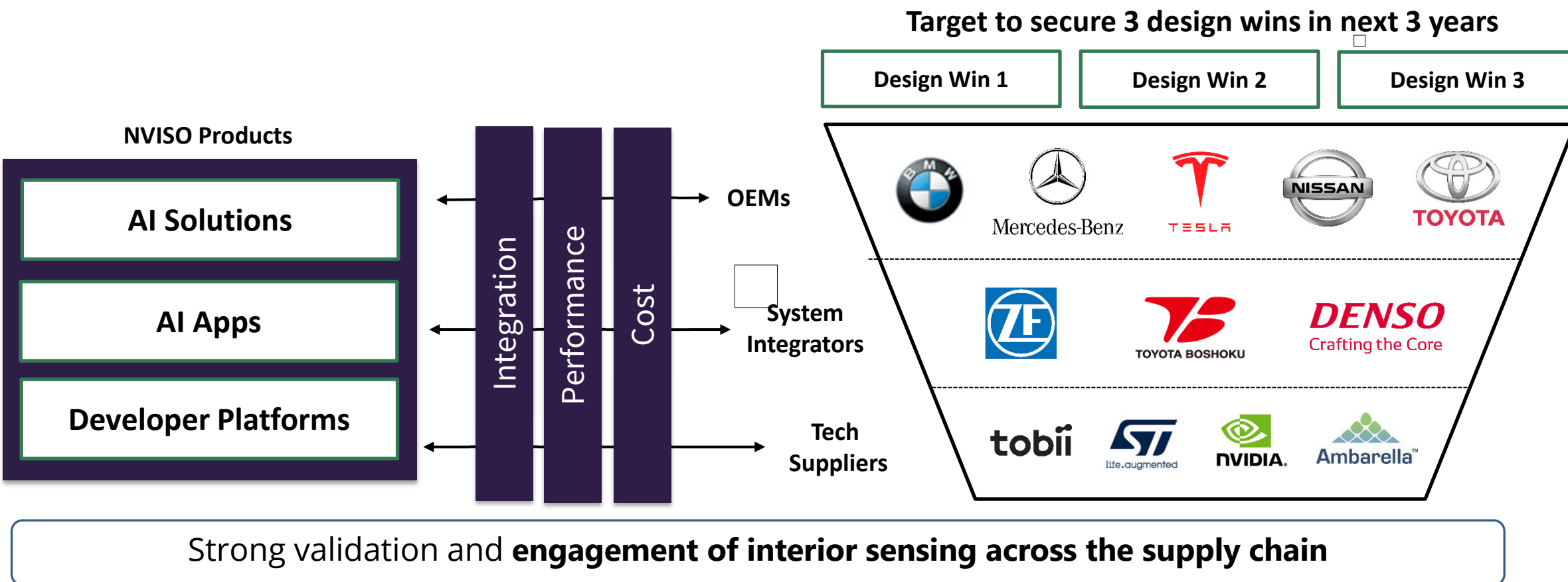
Technology direct to OEM or via System Integrator



Technology joint/venture shorten integration time and lowers costs for OEMs

Validation and Engagement

Engagement and validation across entire Automotive supply chain



Graph: NVISO Business Plan

Company Profile

AI Solutions | Neuromorphic Computing Enhanced

NVISO Neuro SDK | BrainChip Partnership

brainchip
Essential AI

AI App interoperability with world's first fully-digital neuromorphic processor

Who is BrainChip?

- BrainChip's first-to-market silicon-proven, event-based AI processor IP, Akida™, is based on neuromorphic principles - mimicking the human brain. BrainChip enables effective edge compute to be universally deployable across real-world applications such as connected cars, consumer electronics, and industrial IoT.
- BrainChip Akida benefits for NVISO edge applications
 - Power Efficient** - extreme energy efficiency for always-on devices
 - High Throughput** – runs many networks simultaneously
 - Ultra-Low Latency** – execute in milliseconds not seconds
 - One-Shot Learning** - on-device learning from little data

NVISO Achievements

- Porting four (4) NVISO AI Apps to BrainChip Akida in 3 months
- Fully qualification and characterisation and benchmarking versus CPU / GPU
- Release of EVK for demonstration and customer engagement



PRESS RELEASE

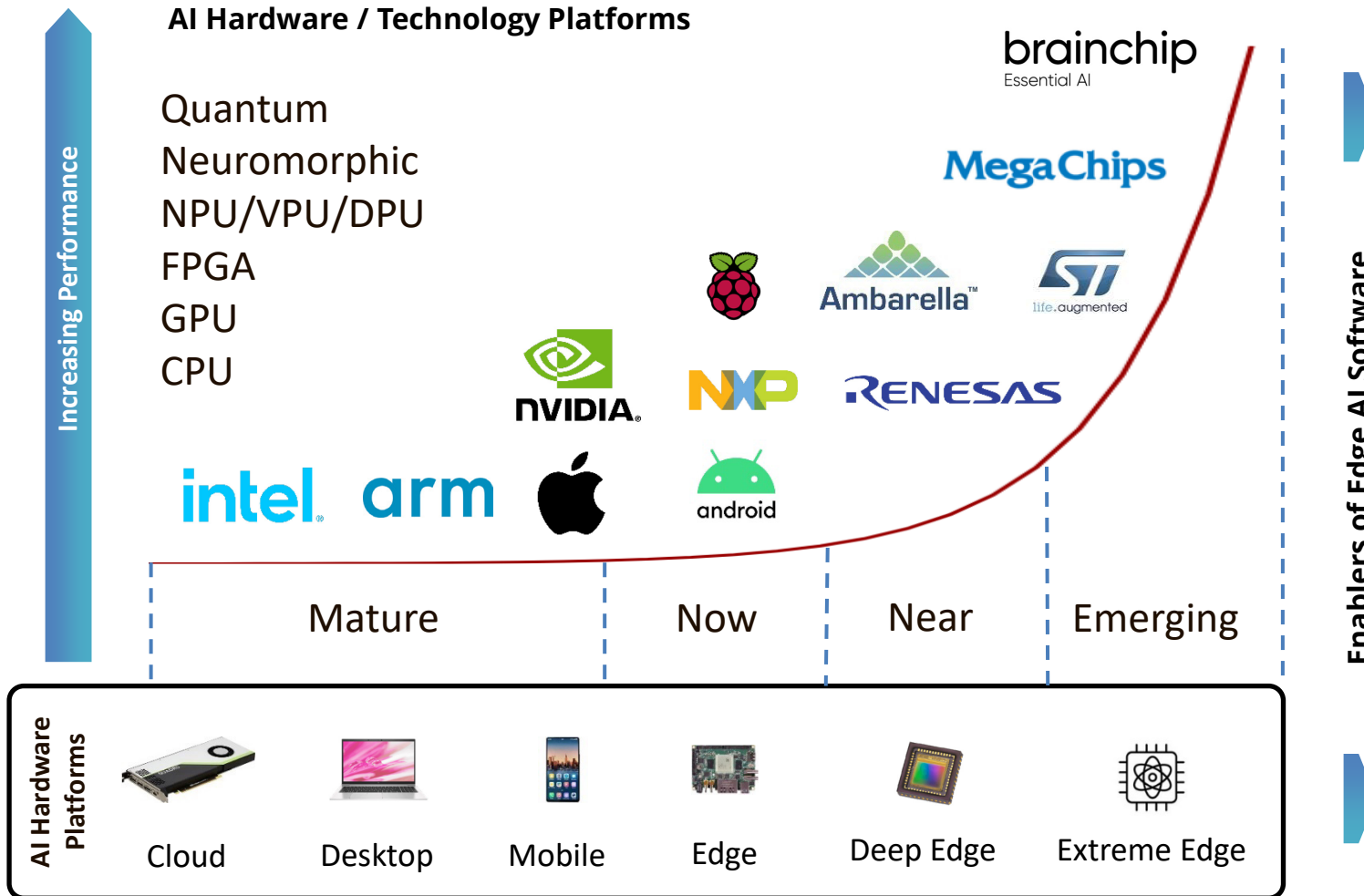
NVISO advances its Human Behaviour AI SDK for neuromorphic computing using the BrainChip Akida platform

<https://www.nviso.ai/en/events/ai-expo-2022>

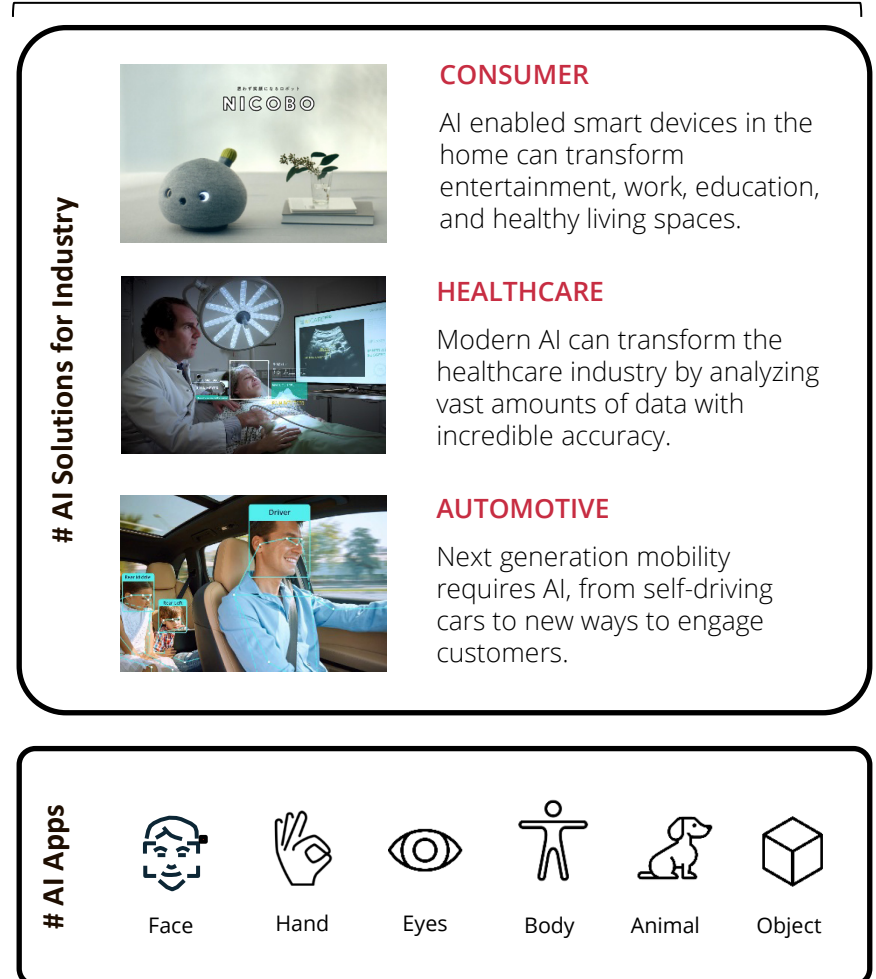
Four (4) **NVISO AI Apps are interoperable** with world's first fully-digital neuromorphic processor

Image: NVISO – AI Expo Japan April 2022

Accelerated Adoption | AI IoT + Neuromorphic Computing + AI Apps

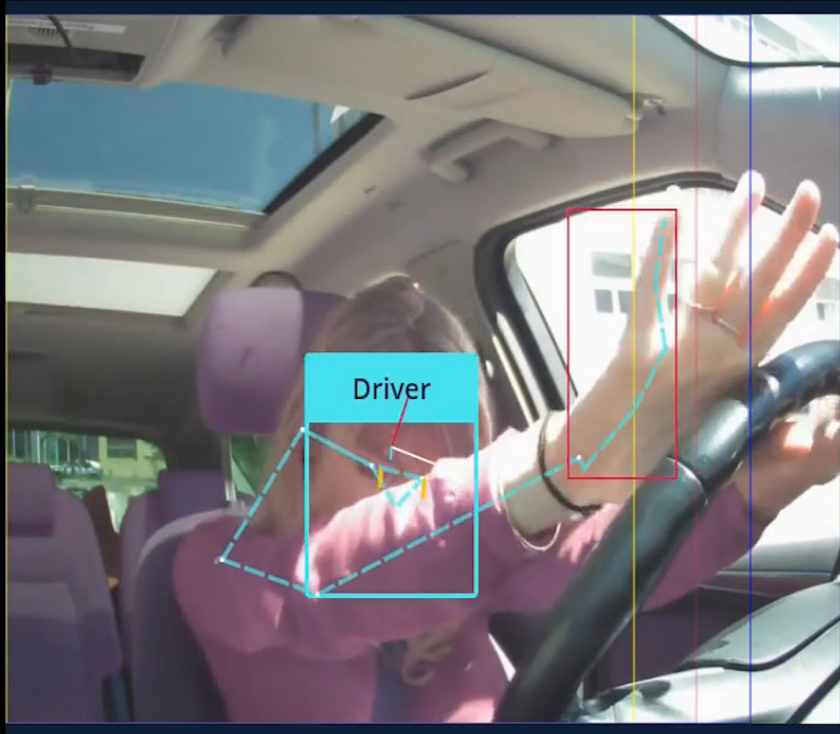


Example NVISO Industry Verticals



Accelerated Adoption | Robust in Real-World Environments

NVIDIA GPU
Precision 32 to 8-bit



BrainChip Akida (Headpose Only)
Precision 4-bit



Edge

100
FPS+



Extreme
Edge

1000
FPS+

NVISO Neuro SDK | BrainChip Performance Evaluation

- Software and Hardware**

- NVISO Neuro EVK incorporating five (5) CNN based models for Human Behaviour AI
- NVIDIA Jetson Nano 4GB Developer Kit
- BrainChip Akida 1000 PCI Express Card

- Benchmark**

- Five (5) NVISO Neuro Models with identical
 - #params / architecture
 - input size / outputs
 - batch size = 1
- Three (3) inference runtimes
- Two (2) hardware platforms

NVISO



PROVIDER
NVISO advances its Human Behaviour AI SDK for
neuromorphic computing using the BrainChip
Akida platform

NVIDIA Jetson
Nano (4GB)

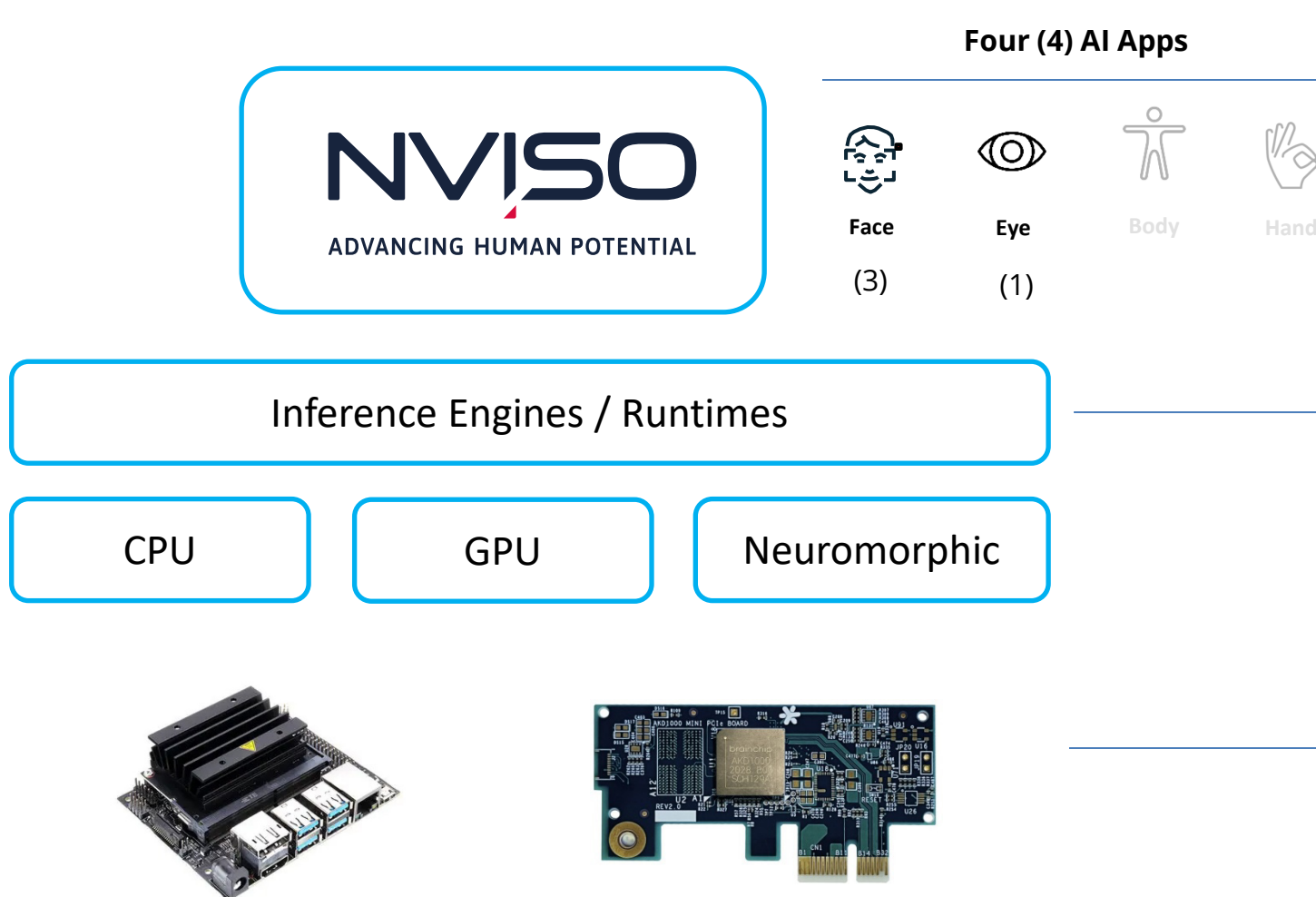


brainchip
Essential AI



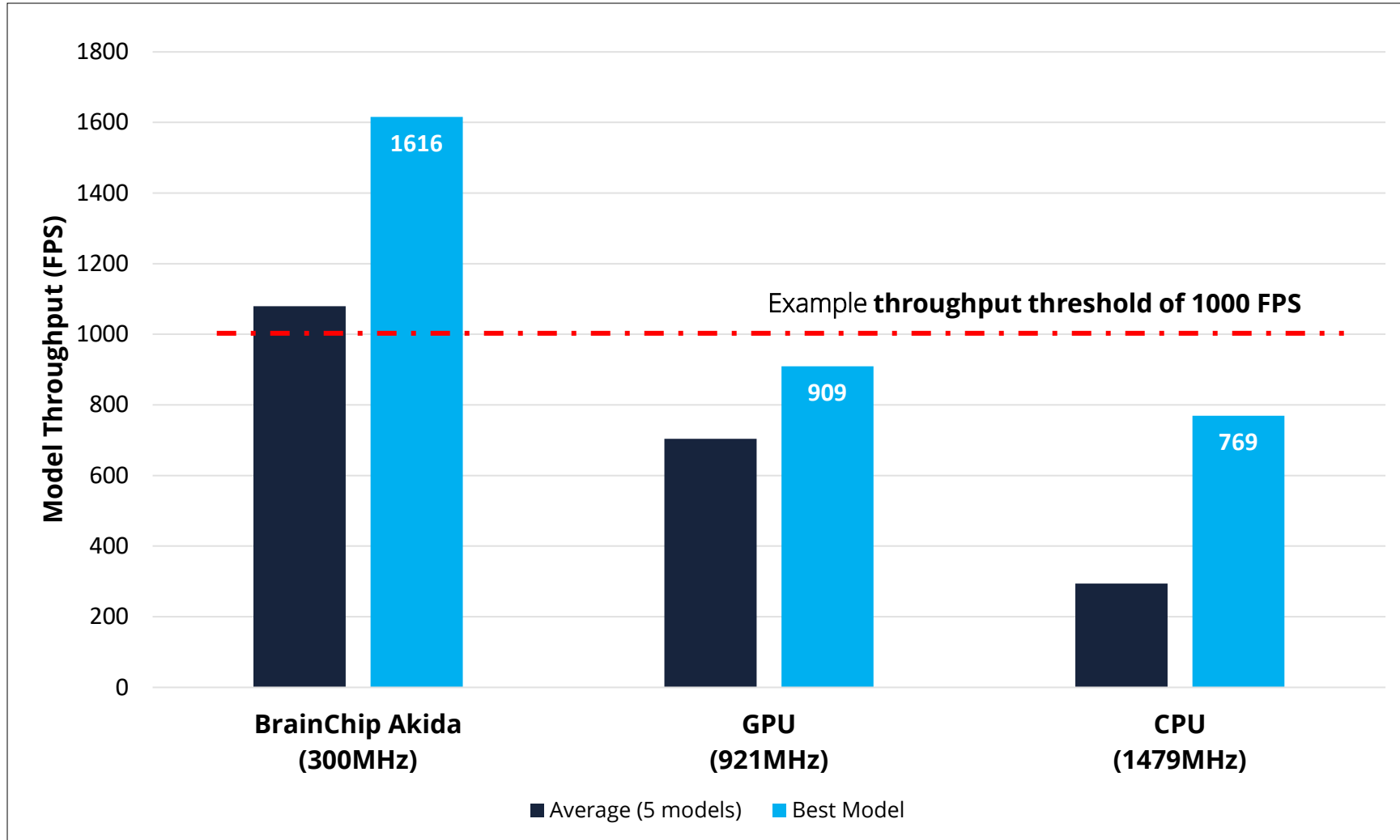
	NVIDIA Jetson Nano	BrainChip
CPU	ARM A57 (Camel V8.2)	ARM M4
Neural Acceleration	CUDA based GPU	Akida
Frequency (MHz)	921 (GPU) / 1479 (CPU)	300

NVISO Neuro SDK | BrainChip Performance Evaluation



- **Five (5) NVISO Neuro Models Under Test**
 - Input Sizes (48x48 to 112x112)
 - Headpose / Gaze
 - Facial Expressions
- **Inference Engines / Runtimes**
 - TensorRT 8.0.1
 - BrainChip Akida Runtime 2.2.2
 - LPDNN v0.4
 - ONNX Runtime 1.10
- **Hardware Platforms**
 - NVIDIA Jetson Nano (4GB)
 - BrainChip Akida

NVISO Neuro SDK | Throughput exceeding 1000 FPS



Model Throughput (FPS) vs Platform

NVISO Neuro Model performance can be accelerated by an average of 3.67x using neuromorphic computing over a single core ARM Cortex A57 as found in a NVIDIA Jetson Nano (4GB). On a clock frequency normalization basis, this represents an acceleration of 18.1x.

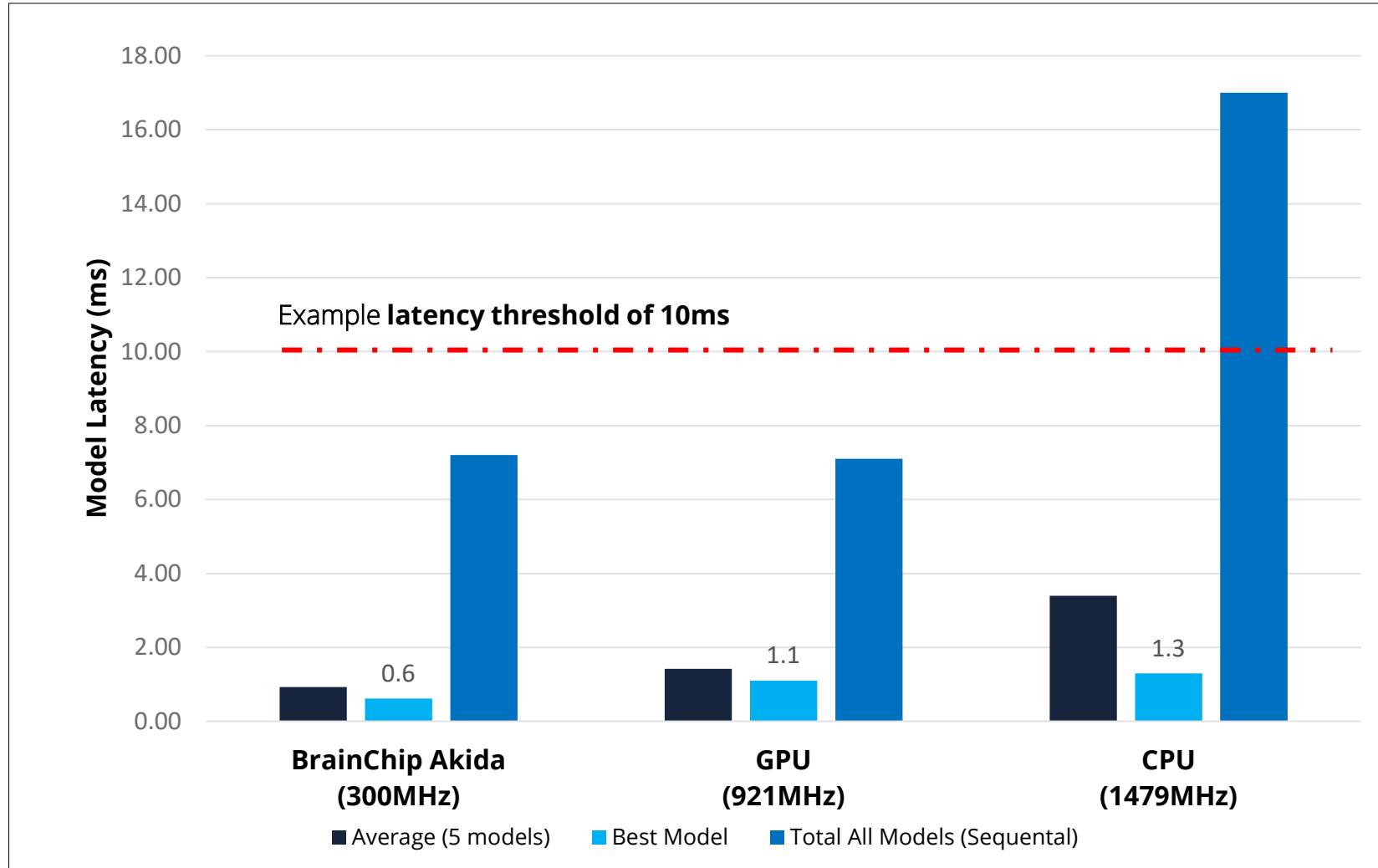
When compared to the GPU, this acceleration represents 1.53x and 4.69x respectively.

CPU = Single ARM Cortex A57

GPU = Single NVIDIA Tegra X1

Batch size = 1

NVISO Neuro SDK | Latency less than 1ms



Model Latency (ms) vs Platform

NVISO Neuro Model latency (ms) can be summarized in the following table.

	BrainChip Akida	Jetson Nano 4GB GPU	Jetson Nano 4GB CPU
Emotion Front	2.5	1.4	4.7
Emotion Rear	0.7	1.1	1.3
HeadPose	2.8	1.6	7.9
Eye Gaze Right	0.6	1.5	1.6
Eye Gaze Left	0.6	1.5	1.5
Total	7.2	7.1	17.0

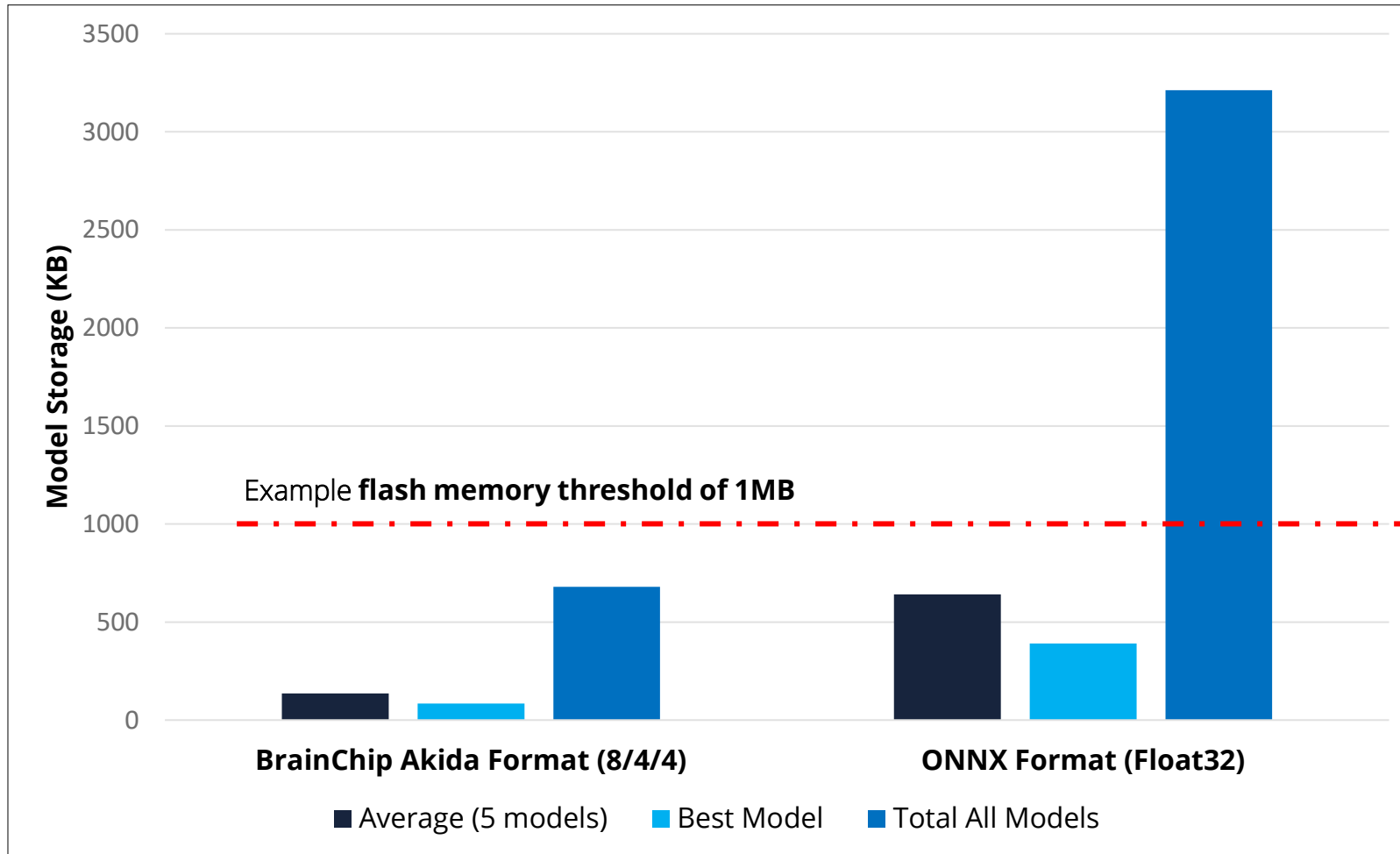
Total model latency is similar for GPU and BrainChip Akida, however CPU latency is approximately 2.4x slower. All models on all platforms can achieve <10ms latency and the best model can achieve 0.6ms.

CPU = Single ARM Cortex A57

GPU = Single NVIDIA Tegra X1

Batch size = 1

NVISO Neuro SDK | Storage under 1MB



Model Storage (KB) vs Platform

NVISO Neuro Models can achieve a model storage size under 1 MB targeting ultra-low power MCU system where onboard flash memory is limited. Removing the need for external flash memory saves cost and power.

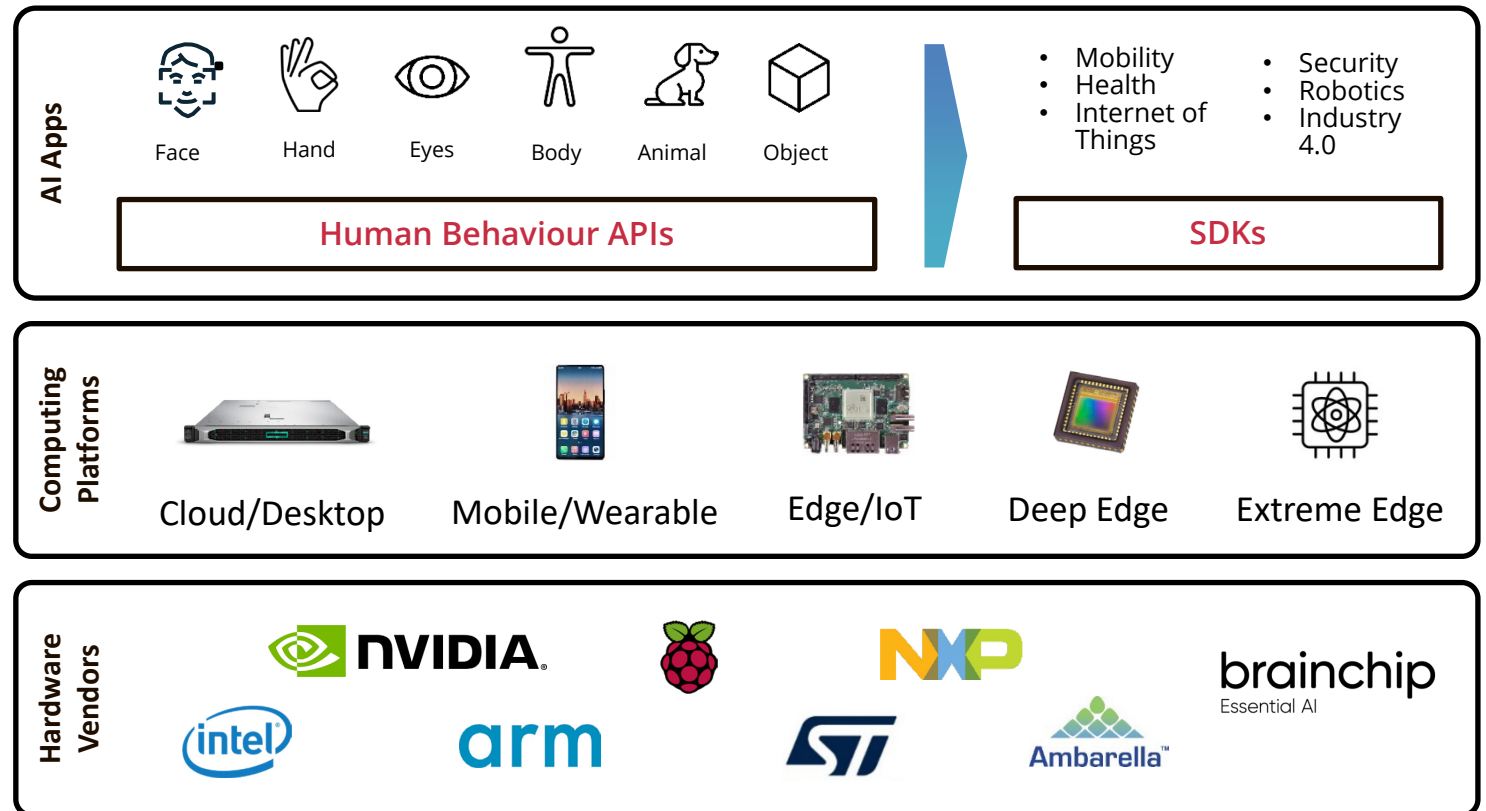
AKIDA (8/4/4) = 680 KB

ONNX (Float) = 3'213 KB

Monetising the Data | AI Applications solving Industry Problems

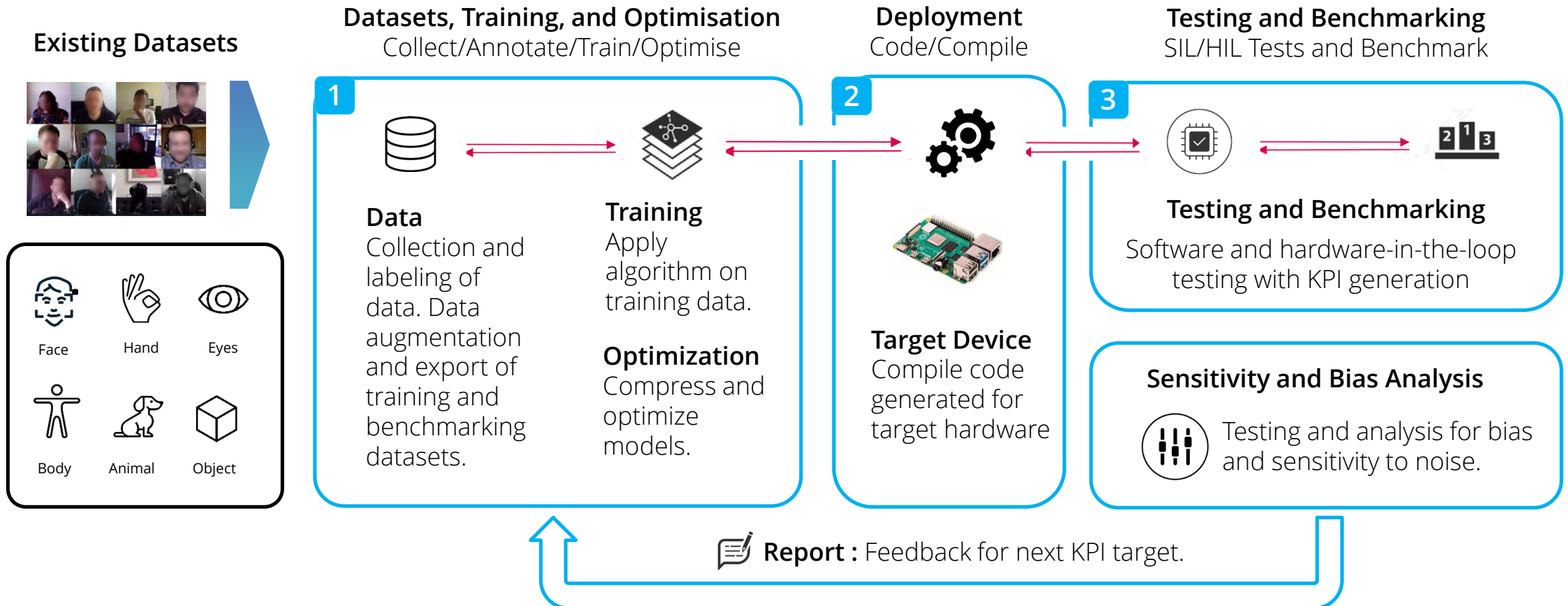
AI Apps and Solutions for edge device is far more demanding due to the limitations in terms of computation and storage abilities when compared to cloud-based systems.

Developer Platforms for ultra-low power, always-on, battery powered devices require porting of the trained model from the training environment to the target device, e.g., a low-power microcontroller, including the implementation of all necessary pre and post-processing steps of the AI App. This is a complex step as it involves several data and code conversions as well as low-level optimisations for a given hardware vendor.

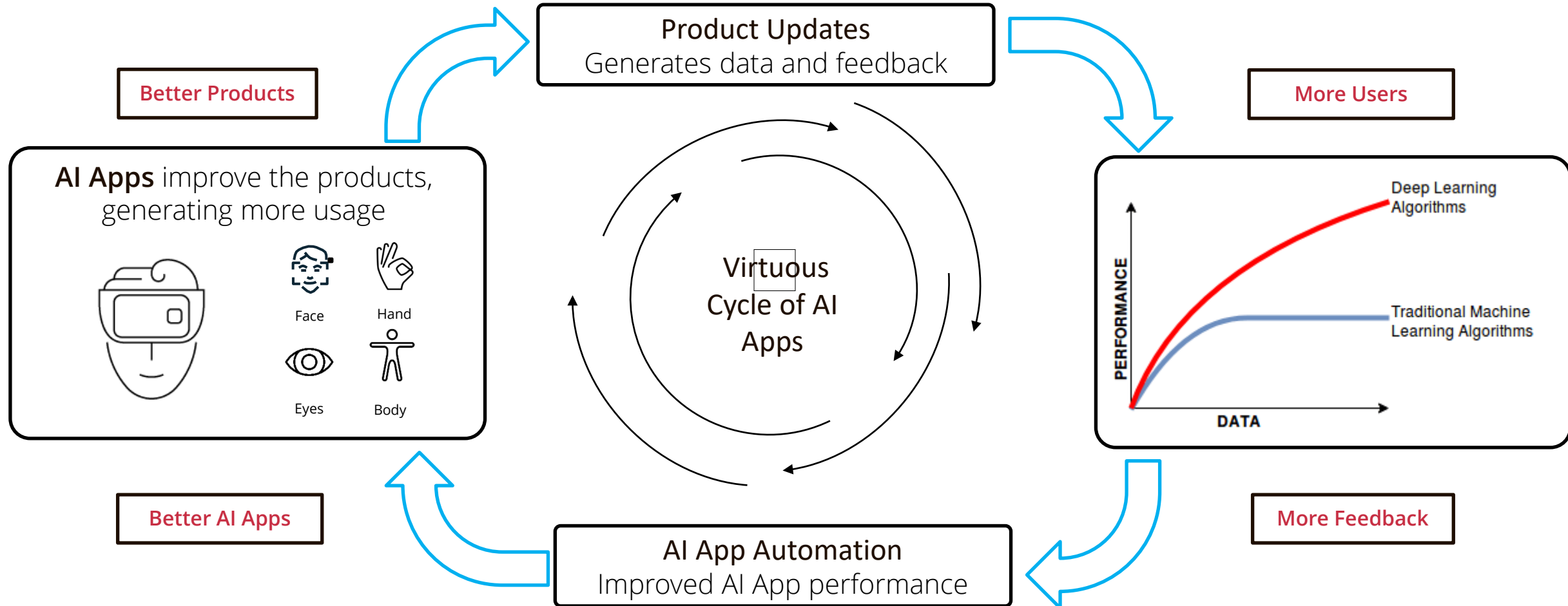


10 years of R&D developing state-of-the AI Apps for **detecting human behavior on edge devices**

The Magic | Data-Centric AI App Automation



The Unfair Advantage | AI “Flywheel” Network Effect



Lower Power and Latency | ~2x Performance Gains on ARM CPUs Alone

Average of THROUGHPUT	Column Labels		
Row Labels	Ine	onnxruntime	tensorrt
imx8m-nano	4.5	1.9	
128x96	8.0	3.2	
192x144	3.5	1.6	
256x192	2.1	1.0	
jetson-nano2	7.7	3.2	20.3
128x96	13.3	5.4	26.4
192x144	6.0	2.6	19.4
256x192	3.7	1.7	15.3
jetson-xav-agx	16.3	7.0	51.3
128x96	28.4	11.9	79.6
192x144	12.7	5.6	44.8
256x192	7.9	3.7	29.6
rpi3	3.4	1.5	
128x96	5.9	2.5	
192x144	2.6	1.3	
256x192	1.6	0.8	
rpi4	7.1	3.2	
128x96	12.9	5.3	
192x144	5.2	2.7	
256x192	3.1	1.7	
Grand Total	7.8	3.9	38.9

- Automated toolchain explores multiple inference engines. LPDNN (LNE), ONNX Runtime, and TensorRT at runtime to find best configuration for a given platform. Currently supports MCUs, CPUs, GPUs, and NPUs. Neuromorphic computing currently under development.
- Benchmarks of AI Apps include pre-processing, model inference, and post-processing on multiple platforms e.g. example shown on NXP iMX8m-Nano, NVIDIA Jetson Nano, NVIDIA Jetson AGX, and RaspberryPi3/4, however over 20 platforms currently supported.
- Different input sizes are included in benchmarks.
- LPDNN (LNE) Inference Engine ~2x Faster** for ARM CPUs than ONNX Runtime. AI App performance (latency and power) heavily depends on:
 - Hardware selected
 - Software based inference engine (including pre and post-processing)
- For AI Apps requiring lowest latency or lowest power consumption both **software and hardware must be carefully selected together.**

Disclaimer

NVISO SA (**NVISO**). This document does not purport to contain all the information that a prospective investor may require in connection with any potential investment in NVISO. You should not treat the contents of this presentation, or any information provided in connection with it, as financial product advice or advice relating to legal, taxation or investment matters. This presentation and the information contained herein and all electronic and/or hard copy documentation which comprise it are being provided to you solely for your information and may not be copied, reproduced, distributed, disclosed or published, in whole or in part, to any other person for any purpose whatsoever at any time without the prior written consent of NVISO. This presentation is not an offer to any person nor is it a prospectus.

This document has been prepared based on information available to NVISO at the time of preparation. No representation or warranty (whether express or implied) is made by NVISO or any of their officers, advisors, agents or employees as to the accuracy, completeness or reasonableness of the information, statements, options or matters (express or implied) arising out of, contained in or derived from this presentation or provided in connection with it, or any omission from this presentation, nor as to the attainability of any estimates, forecast or projections set out in this presentation.

This presentation is not investment or financial product advice (nor tax, accounting or legal advice) and is not intended to be used for the basis of making an investment decision. The information contained in this presentation has been prepared without taking into account the objectives, financial situation or needs of individuals. This presentation is provided expressly on the basis that you will carry out your own independent inquiries into the matters contained in the presentation and make your own independent decisions about the affairs, financial position or prospects of NVISO. NVISO reserves the right to update, amend or supplement the information at any time in its absolute discretion (without incurring any obligation to do so).

NVISO, nor its related bodies corporate, officers, their advisors, agents and employees accept any responsibility or liability to you or to any other person or entity arising out of this presentation including pursuant to the general law (whether for negligence, under statute or otherwise), or under the Australian Securities and Investments Commission Act 2001 (Cth), Corporations Act 2001 (Cth), Competition and Consumer Act 2010 (Cth) and any such responsibility or liability is, to the maximum extent permitted by law, expressly disclaimed and excluded. Nothing in this material should be construed as either an offer to sell or a solicitation of an offer to buy or sell securities. It does not include all available information and should not be used in isolation as a basis to invest in NVISO.

Future Matters

This presentation contains reference to certain intentions, expectations, future plans, strategy and prospects of NVISO. Those intentions, expectations, future plans, strategy and prospectus may or may not be achieved. They are based on certain assumptions, which may not be met or on which views may differ and may be affected by known and unknown risks.

The performance and operations of NVISO may be influenced by a number of factors, many of which are outside the control of NVISO. No representation or warranty, express or implied, is made by NVISO, or any of their directors, officers, employees, advisors or agents that any intentions, expectations or plans will be achieved either totally or partially or that any particular rate of return will be achieved. Given the risks and uncertainties that may cause NVISO's actual future results, performance or achievements to be materially different from those expected, planned or intended, recipients should not place undue reliance on these intentions, expectations, future plans, strategy and prospects. NVISO does not warrant or represent that the actual results, performance or achievements will be as expected, planned or intended.

NVISO Risks

Risk Description	
Transactional Risk	
Lack of Market	There is currently no public market for NVISO's fully paid ordinary shares (Shares), the price of Shares is subject to uncertainty and there can be no assurance that an active market for the Shares will develop or continue in the future. While NVISO may ultimately list on ASX, there is no certainty that this will occur.
Financing and Dilutionary Risk	The success of reaching an IPO is subject to many risk factors including the success of interim capital raising, market conditions and/or business opportunities. Even if NVISO is successful in closing future financing there is no guarantee that an IPO will take place. If the company can not attract future financing, it could stop to be a going concern if it can not secure customers for its products and services. NVISO reserves the right to explore any alternative structures/solutions in the future. The Company may elect to restructure its corporate organisation in the future which may dilute and affect investors and shareholders interests. Currently issued ordinary shares are 130.9 million, \$3.37m of convertible debt, and additionally there are 20 million performance shares, 20 million unlisted options, and 10 million management/advisor/lender options.
General Risks	
General risks	There are a range of general risks that are relevant to a potential investment in NVISO, including but not limited to, economic, the fact that NVISO may have additional requirements for capital, regulatory risks, and taxation, amongst others.
Future Liquidity	There is no guarantee that NVISO will be admitted to the ASX or that there will be an ongoing liquid market for NVISO's securities. Accordingly, there is a risk that should an ASX listing not be achieved or should the market for NVISO's securities become illiquid, shareholders will be unable to realise their investment in NVISO.
Economic	General economic conditions, introduction of tax reform, new legislation, movements in interest and inflation rates and currency exchange rates may have an adverse effect on NVISO or NVISO's activities, as well as on its ability to fund those activities.
Regulatory	Changes in relevant taxes, legal and administration regimes, accounting practice and government policies may adversely affect the financial performance, financial position and activities of NVISO or NVISO.
Investment speculative	The list of risk factors ought not to be taken as exhaustive of the risks faced by NVISO or by investors in NVISO. The risk factors, and others not specifically referred to in this list, may in the future materially affect the financial performance of NVISO and the value of the Shares. Therefore, any Shares to be issued carry no guarantee with respect to the payment of dividends, returns of capital or the market value of those Shares. Potential investors should consider that the investment in NVISO is highly speculative and should consult their professional advisers before deciding whether to apply for Shares in NVISO.
Operational Risks relating to NVISO	
Patent application risk	As discussed below (Technology risks), NVISO intends to offer its products and services internationally. NVISO has applied for a patent, which is still pending. There is no guarantee that this patent application will be granted or that NVISO will receive enforceable patent rights. There is a risk that NVISO will not be entitled to practice the inventions claimed in the patent, and that the working of its patented invention may be prevented by another patent or patent application which has an earlier priority date to the patent applications licensed to NVISO. Even if NVISO succeeds in obtaining patent protection for its products, its patent could be partially or wholly invalidated following challenges by third parties. The grant of a patent does not guarantee validity of that patent since it may be revoked on the grounds of invalidity at any time during its life. If none of the claims of a granted patent are valid, the patent is unenforceable.
Protection of intellectual property rights	NVISO has trade secrets and other intellectual property rights that are important assets. NVISO may therefore rely on a combination of confidentiality and license agreements with its consultants, employees, and third parties with whom it has relationships, as well as patents, domain names, trade secrets and copyright, to protect its brand and other intellectual property rights. There is a risk that NVISO may be unable to detect the unauthorised use of its intellectual property in all instances. Further, actions taken by NVISO to protect its intellectual property may not be adequate or enforceable and therefore may not prevent the misappropriation of intellectual property and proprietary information. NVISO's failure to protect its intellectual property rights could have an adverse impact on NVISO's operations and financial performance. NVISO may be required to incur significant expenses in monitoring and protecting its intellectual property rights. NVISO may initiate or otherwise be involved in litigation against third parties for infringement, or to establish the validity, of its rights. Any litigation, whether or not it is successful, could result in significant expense to NVISO and cause a distraction to Management. In addition, unauthorised use of NVISO's brand or intellectual property by third party products or services may not only result in potential revenue loss, but also have an adverse impact on NVISO's brand value and the market perception of the quality of its products.

Risk Description	
Operational Risks relating to NVISO	
International Operations	NVISO intends to do business internationally. NVISO's operations will therefore be subject to a number of risks inherent in international operations, including: (i) political and economic instability in foreign markets; (ii) inconsistent product regulation by foreign agencies or governments; (iii) imposition of product tariffs and burdens; (iv) costs of complying with a wide variety of international laws; (v) risks stemming from NVISO's lack of local business experience in specific foreign countries; (vi) foreign currency fluctuations; (vii) difficulty enforcing intellectual property rights; (viii) foreign taxes; and (ix) language and other cultural barriers.
Technology risks	<p>The market for emotion analytics and AI and associated products and services is characterised by rapid technological change and advancement, audio and visual advances, medical advances, changing consumer and user requirements, short device lifecycles and evolving industry standards. Any one of these factors could reduce demand for our products and/or services and require substantial resources and expenditures for research, design and development to avoid technological or market obsolescence.</p> <p>NVISO's success will depend upon its ability to enhance current technology, services and systems to develop or acquire and market new technologies to keep pace with technological developments and evolving industry standards, while responding to customer and user needs. A failure to adequately develop or acquire new technologies or product enhancements that will address changing technologies and customer or user requirements adequately, or to introduce such technology on a timely basis, may have a material adverse effect on NVISO's business, financial condition and results of operations.</p> <p>NVISO might have insufficient financial resources to improve existing technologies, advance technologies and develop new technologies at competitive prices. Technological advances by one or more competitors or future entrants into the artificial intelligence space may result in NVISO's present services or technology offerings becoming non-competitive or obsolete, which may decrease revenues and profits and adversely affect NVISO's business and results of operations.</p>
Changes in strategy	NVISO's strategy may evolve over time due to a review and assessment of, among other things, market trends, technical challenges, changes in regulations, the level of market acceptance in particular jurisdictions or markets and the emergence of new or improved technology. As a result, the future strategies, approaches, markets, products and plans of NVISO may not reflect the strategies, approaches, markets, products and plans set out in this presentation.
Access to data	Improvements to NVISO's products and services rely on access to data. The data is currently acquired from the usage of the NVISO's products and various collaborative R&D projects. The data, such as pictures and videos of human faces with the knowledge of the emotion presented in the given picture or video, is used to improve NVISO's existing products and to build new AI based products. If for any reason, regulatory or other, NVISO's ability to obtain data is limited, this may result in increased costs in order to develop or acquire required datasets.
Intellectual Property	<p>NVISO's prospects will depend on its ability to develop and protect technology that meets changing market needs and addresses the technological advances and competitiveness of other companies operating in the markets targeted by NVISO.</p> <p>NVISO's interest in its technologies is protected by a pending patent application. Whilst this provides NVISO with protection, there is no guarantee that other companies will not legally challenge the patent or that they might knowingly or unknowingly infringe NVISO's patent. Any such action may adversely affect the business, operating results and financial condition of NVISO.</p> <p>NVISO SA could also be subject to claims by employees and service providers under Swiss law with respect to intellectual property developed by them.</p> <p>NVISO's considers that moving forward it will be important that NVISO maintains and obtains patents and that trade secrets and other proprietary know how is sufficiently protected to ensure the viability of NVISO's technologies.</p>
Reliance on Key Management Personnel	<p>The responsibility of overseeing the day-to-day operations and the strategic management of NVISO depends substantially on its senior management and its key personnel. No assurance can be given that there will be no detrimental impact on NVISO if one or more of these employees cease(s) their employment or if one or more of the Directors cease to be directors of NVISO.</p> <p>Success of the business will depend on the Directors and the officers of NVISO to develop the business and manage operations, and on the ability to attract and retain key quality staff and consultants.</p> <p>The management team is currently comprised of a team of personnel who the Directors consider can cover on a temporary basis for any other member of the team who may leave NVISO, until such time as NVISO engages a replacement. However, the loss of multiple key persons or the inability to find new key persons (or delays in finding such key persons) could have a material adverse effect on the business.</p>
Changes to Regulations affecting NVISO	The regulatory requirements for NVISO's technologies are currently minimal. If the regulatory framework was to change requiring necessary approvals to operate or use the NVISO technology, NVISO may not be able to obtain such necessary approvals or clearances in a timely fashion or may not be able to obtain the necessary approvals and clearances at all.

Risk Description	
Foreign Exchange Risk	While NVISO transacts business internationally, the operations of NVISO are primarily in Switzerland and NVISO intends to raise capital in Australian dollars. Accordingly, a foreign exchange risk exists in relation to any significant fluctuations in currency exchange rates.
New Technology and Competition	While NVISO has technology that is at the forefront of its market, this does not preclude other alternative ideas or technologies being developed and overtaking the performance or utility of the NVISO technology. This is a risk as there is significant investment by large technology businesses in the areas of machine learning and AI. Such an investment may promote the development of improved technologies that could provide a significant commercial threat to NVISO.
Competitive environments in the industry applications	<p>In respect of the application of NVISO's technology to the financial services industry, there is a risk that large technology businesses would enter the market and due to relevant scale would have the ability to offer relevant services to the market at very low costs. This would allow data to be collected faster and therefore enhance other products that would compete with NVISO.</p> <p>In respect of the application of NVISO's technology healthcare industry there is a risk that an established healthcare services provider would enter the market. Such provider would likely have large existing datasets enabling them to build and validate new AI based products more efficiently than NVISO. This risk is mitigated by close collaboration with such businesses making NVISO a relevant partner to them, providing innovation quicker than their internal processes.</p> <p>If the capabilities offered by NVISO to automotive industry become standard features in vehicles, there is a risk that the automotive OEMs and Tier1 suppliers develop AI features individually rather than relying on existing developers such as NVISO. NVISO mitigates these risks by providing competitive and flexible business models and pricing in the given industry.</p>
New Technology with Limited Testing and Feedback	<p>NVISO's prospects will depend on its ability to develop technology that meets changing market needs and addresses the technological advances and competitiveness of other companies operating in the AI solution market.</p> <p>The NVISO technology and its products are relatively new and may require lengthy testing and development before they are commercially viable for application and sale in relevant industries. Ongoing testing and trials may delay NVISO achieving immediate sales in the short to midterm following admission to the ASX.</p>
Limited Commercial Application to Date	<p>The technologies for emotional AI are still an immature market in a commercial sense. Due to the early stage nature of the market, there is no single paradigm on what the best method is for achieving commercial success.</p> <p>NVISO's sales have been limited due to restrictions in working capital and NVISO's focus on products and R&D.</p> <p>Investors should be aware that past performance should not be relied upon as being indicative of future performance.</p> <p>NVISO may have to expend a great deal of funds in advertising and marketing in order to reach its intended clients and customers. NVISO's technologies may require substantial upfront capital investment that has not yet been identified, and there can be no assurance that subsequent operational objectives will be achieved. Failure to achieve objectives/ milestones may have a material adverse impact on the financial performance of NVISO.</p>
Future profitability or dividends are not assured	No assurance as to future profitability or dividends can be given and these are dependent on future earnings and working capital requirements of NVISO. Potential investors should note that there can be no guarantees with respect to the payment of dividends and return of capital.
Cost of technology	Although NVISO will eventually seek to market its technology into mid and low-income countries, the costs of implementing the technologies may prove too expensive for consumers in those countries. Should this prove to be the case this could result in reduced gross margins and loss of potential market share, either of which could materially adversely affect NVISO's future business, operating results and financial position.
Restricted Securities	NVISO anticipates that certain Shares and Options and will be classified as restricted securities by ASX upon Admission. Shares held by the Founders, Timothy Llewellyn and Matteo Sorci, will be subject to a voluntary escrow period and these Shares will only be released upon the satisfaction or achievement of certain performance milestones. These securities will be subject to an escrow period of up to 24 months from the date of Official Quotation. This could be considered to be an increased liquidity risk as a portion of NVISO's issued capital will not be able to be traded freely for a period of time.
Research & Development Risk	Robotics and artificial intelligence companies typically engage in significant amounts of spending on research and development, and there is no guarantee that the products or services produced by these companies will be successful. Further, rapid changes to the field could have a material adverse effect on NVISO's operating results. Robotics and artificial intelligence companies, especially smaller companies, tend to be more volatile than companies that do not rely heavily on technology.

Risk Description	
Hacking and security breaches	<p>NVISO may be adversely affected by malicious third party actions that seek to breach security of the platform. Any such 'hacking' of the platform could, among other things, jeopardise the security of customer information stored by NVISO. If NVISO's efforts to combat such malicious actions are unsuccessful, or if their data storage or platform has actual or perceived vulnerabilities, NVISO's business reputation and brand name may be harmed, which may result in a loss of customers from the platform (and reduced prospects of securing new customers).</p> <p>NVISO currently uses cloud services such as IBM SoftLayer and Amazon S3. IT security and the protection of customer data is critical to NVISO's success. To this end, NVISO has installed 'state-of-the-art' firewalls and data encryption, and undertakes due diligence on security policy compliance when using third party infrastructure. To further improve its data security, NVISO has initiated its ISO 27001 certification. This established a management system that is intended to ensure that information security is under management control and meets specific requirements. Organizations that meet the requirements may be certified by an accredited certification body following successful completion of an audit. NVISO has set a target of passing the audit and obtaining the ISO 27001 standard in Q2, 2019. NVISO has also adopted a number of internal information management and security policies which regulate the use of the NVISO's IP.</p>
Service Interruptions/ technology outages	<p>NVISO relies on its technology to provide its customers with reliable service. There may be a failure to deliver this level of service due to factors such as:</p> <ul style="list-style-type: none"> (i) Human error; (ii) Power loss; (iii) Improper building/ storage maintenance; (iv) Physical or electronic security breach; (v) Natural disaster/ damage; (vi) War, terrorism and any related conflicts worldwide; and (vii) Sabotage and vandalism. <p>Service interruptions may trigger clauses in contracts which could result in terminations, award of compensation and other potential expenses to NVISO. Service interruptions may further expose NVISO to additional legal liability or erosion of reputation.</p>
Ethics	<p>Ethical concerns surrounding artificial intelligence are becoming more and more important as its prevalence grows. Decisions made by AI agents can be faster, more accurate and more suitable to complex and dynamic contexts than decisions made by humans. However, in some situations there is no objective view on what the optimal decision should be, because that depends on the ethical principles adopted to draw conclusions. Studies suggest training technology to decide based on interpretation of situations and the stakeholder and stakes involved is helpful. Such interpretative effort is complicated for AI systems unable to comprehend abstract concepts such as human emotion or values. The consequence is that depending on its design or the information upon which it is trained, an AI agent may act against human interests.</p>
Bias and Accountability	<p>Beyond responsible testing and development of software, accountability is an important factor of companies making transparent and auditable decisions. Accountability is important in precluding unintended consequences from applications due to input algorithms being human-generated. Consequently, training data can contain prejudice and bias, which may lead to unfair decision-making by nVISO technologies. Transparency of the decision-making process and the underlying training data may assist in achieving an unbiased and impartial outcome regardless of a consumer's characteristics such as race, gender or religion. Such transparency can be enabled by setting up appropriate scrutiny requirements for the artificial intelligence development process.</p>
No representation or warranty as to the accuracy or completeness of the information	<p>The information in this document may not be complete and may be changed, modified or amended at any time by NVISO, and is not intended to, and does not, constitute representations and warranties of NVISO. Neither NVISO, nor any other advisor of NVISO intends to update this document or accepts any obligation to provide the recipient with access to information or to correct any additional information or to correct any inaccuracies that may become apparent in this document or in any other information that may be made available concerning NVISO. Investors should conduct their own due diligence investigations regarding NVISO and the prospects of NVISO's proposed activities.</p>
Additional Capital Requirements	<p>NVISO's capital requirements depend on numerous factors. Additional funding will likely be required by NVISO in the future to effectively implement its business and operations plans, to take advantage of opportunities for acquisitions, or other business opportunities, to keep up with competition, and to meet any unanticipated liabilities or expenses which NVISO may incur. Any additional equity financing will dilute shareholdings, and debt financing, if available, may involve restrictions on financing and operating activities.</p> <p>If NVISO is unable to obtain additional financing as needed, it may be required to reduce the scope of its proposed operations and scale back its expansion programmes as the case may be. There is however no guarantee that NVISO will be able to secure any additional funding or be able to secure funding on terms favourable to NVISO.</p>
Litigation risks	<p>NVISO may be subject to litigation and other claims and disputes in the course of its business, including contractual disputes with customers, suppliers or channel partners, employment disputes, indemnity claims, and occupational and other claims. There is a risk that such litigation, claims and disputes could materially adversely affect NVISO's operating and financial performance due to the costs of defending and/or settling such claims, and affect NVISO's reputation and credibility in the marketplace.</p>



nviso.ai