



brainchip^{*}

ASX: BRN
Spikenet acquisition
September 2016

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Overview of BrainChip



BrainChip has developed a revolutionary Spiking Neuron Adaptive Processor (SNAP) technology that learns autonomously and unsupervised, evolves and associates information just like the human brain

- * SNAP technology provides rapid and autonomous learning, confirmed in the Autonomous Visual Feature Extraction demonstration in March 2016
- * SNAP is deployable across multiple fast-growing markets
- * BrainChip is following a proven Semiconductor industry Intellectual Property (IP) licensing model to deriving its revenue from License, Engineering and Royalty fees

KEY MATRIX	
ASX Code	BRN
Market Cap (post Spikenet acquisition)	A\$96.7M
Share Price (25 Aug 2016)	A\$0.13
Issued Shares (post Spikenet acquisition)	743.9M
Options	24.55M
Cash (30 Jun 2016)	US\$2.90M

Spikenet acquisition summary

BrainChip has acquired France-based
Computer Vision Technology Company
– Spikenet Technology

Spikenet was established in 1999, and has developed breakthrough software for artificial vision and visual pattern recognition.

Spikenet provides programs that are able to learn to recognise objects, faces and patterns. The technology has applications across a range of sectors including security, transport, media, manufacturing and gaming.



Acquisition summary

BrainChip has acquired 100% of Spikenet Technology

Acquisition cost was 10.4 million shares in BrainChip and 529,598 euros

Includes Spikenet's product library and related patent

Cash component fully funded from internal resources

Transaction highlights



Complimentary technology offering with BrainChip focusing on embedded hardware Artificial Intelligence and Spikenet on software only solution



The combined BrainChip and Spikenet solution holds the potential to create the world's most technically advanced, biologically inspired computer vision products



The acquisition provides an immediate path to commercialisation for BrainChip's SNAP technology



Expands the BrainChip offering to include software and hardware solutions



Expected to give BrainChip an immediate source of revenue, recurring income and a ready customer base



Attractively priced acquisition (circa \$2.2 million)



BrainChip can now provide a logical and seamless upgrade path for customers moving from software to hardware solutions



Technological advantage

Spikenet's breakthrough software

- * The brain uses the order in which neurons fire spikes to code information – Spikenet mimics this process
- * Spikenet's Technology works similar to BrainChip's technology but is a software only solution
- * Based on 20 years of research – Spikenet uses image algorithms directly inspired by the strategies used by the human visual system
- * Spikenet's technology holds the potential to outperform even the most sophisticated machine vision systems (aside from BrainChip) and is able to analyse a complex scene in seconds
- * Spikenet will gain an autonomous learning function when integrated with BrainChip



AI BIOLOGY INSPIRED

HUMAN VISION STRATEGIES

SPIKENET, A NETWORK OF SPIKES

ASYNCHRONOUS SPIKING NEURON NETWORK

TEMPORAL CODING, RANK ORDER

VISUAL PATTERN MATCHING



LEARN

ANY VISUAL
PATTERN,
OBJECT






MEMORIZE

RECOGNIZE

SUPERVISED - UNSUPERVISED LEARNING

REAL-TIME

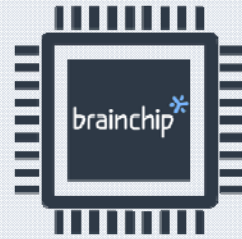
The Spikenet advantage

 High speed	 Accuracy	 Faster deployment	 Adapts to real life	 Learning capabilities
<p>Spikenet can detect more than 5,000 patterns per second on a standard PC</p>	<p>Recognition of exact image and similar patterns with minimal false positives</p>	<p>Software does not require a chip to be produced so it can be deployed faster</p>	<p>Adapts to low resolutions, real life image conditions, still and moving cameras and outdoor constraints</p>	<p>Easier to train to recognise visual patterns when compared to rival “deep learning” solutions</p>



Spikenet + SNAP = A game changer ?

Spikenet's software is predicted to become far more effective when it is supplemented with BrainChip's SNAP autonomous learning technology



A combined solution is expected to create a product that is faster, far more efficient, requires less computing power and is cheaper than anything currently available

The company's objective in combining Spikenet and BrainChip is to provides a game changing technological advantage and a product that is superior to anything else currently in the market

Spikenet + SNAP = A game changer ?

- ✧ Rival advance AI systems like IBM's True North uses "Deep Learning".
- ✧ Deep Learning networks don't actually learn; they need extensive programming to "train" the system how to execute a job function. This is very time and resource consuming.
- ✧ A BrainChip/Spikenet solution would go beyond Deep Learning with autonomous learning that would require very little or no training program.
- ✧ This would enable BrainChip to offer solutions that cut the training time by 95% or more in most cases.

Case study: Shark Detection & ID

Problem



Providing an automatic shark detection and identification system that can operate in all water and weather conditions with minimal false positive alerts.

Current systems



- * Use traditional image processing algorithms with frame-based pixel data processing
- * Processing power and are power intensive, particularly if high resolution images and faster frame rates are used in the analysis
- * Industry turning to Convolution Neural Networks (CNNs) with “deep learning” (backed by Google, Microsoft, etc.)
- * But deep learning on CNNs is also resource intensive. Needs massive cloud-based servers to run
- * CNNs don’t actually learn like humans as it requires a special training programs and thousands of sample photos to recognise objects

BrainChip solution



BrainChip is developing a revolutionary solution that is able to be “taught” quickly, and be used on drones and other portable platforms to significantly reduce costs. The solution may have wide ranging applications.



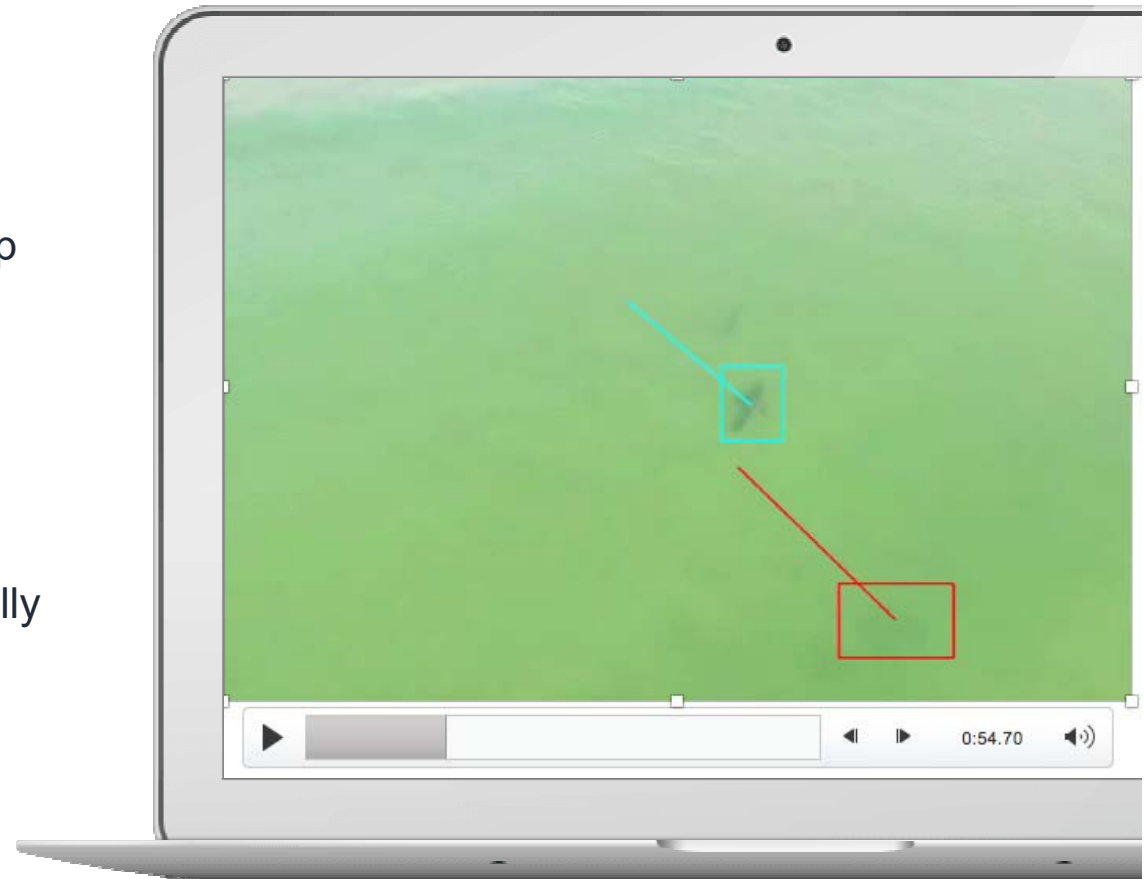
Case study: Shark Detection & ID

Phase 2

Identify all common species of sharks and use an embedded chip solution to achieve greater speed and efficiency.

Phase 1

Create a software solution to automatically detect sharks





Estimated time it would take to program a shark detection system using the different technologies

Deep Learning System

240 man hours to train

System would have to run on a large computer network and still be prone to giving false positives

Spikenet only

10 man hours

System would run on a laptop and <5% false positives

BrainChip/Spikenet

Takes 2 man hours

System would run on a laptop or a small microchip on the drone with <5% false positives

Multiple applications

One technology – thousands of potential solutions



Facial recognition



Mobile Devices



Manufacturing



Gaming



Airport security



Media analysis



Embedded vision sensors

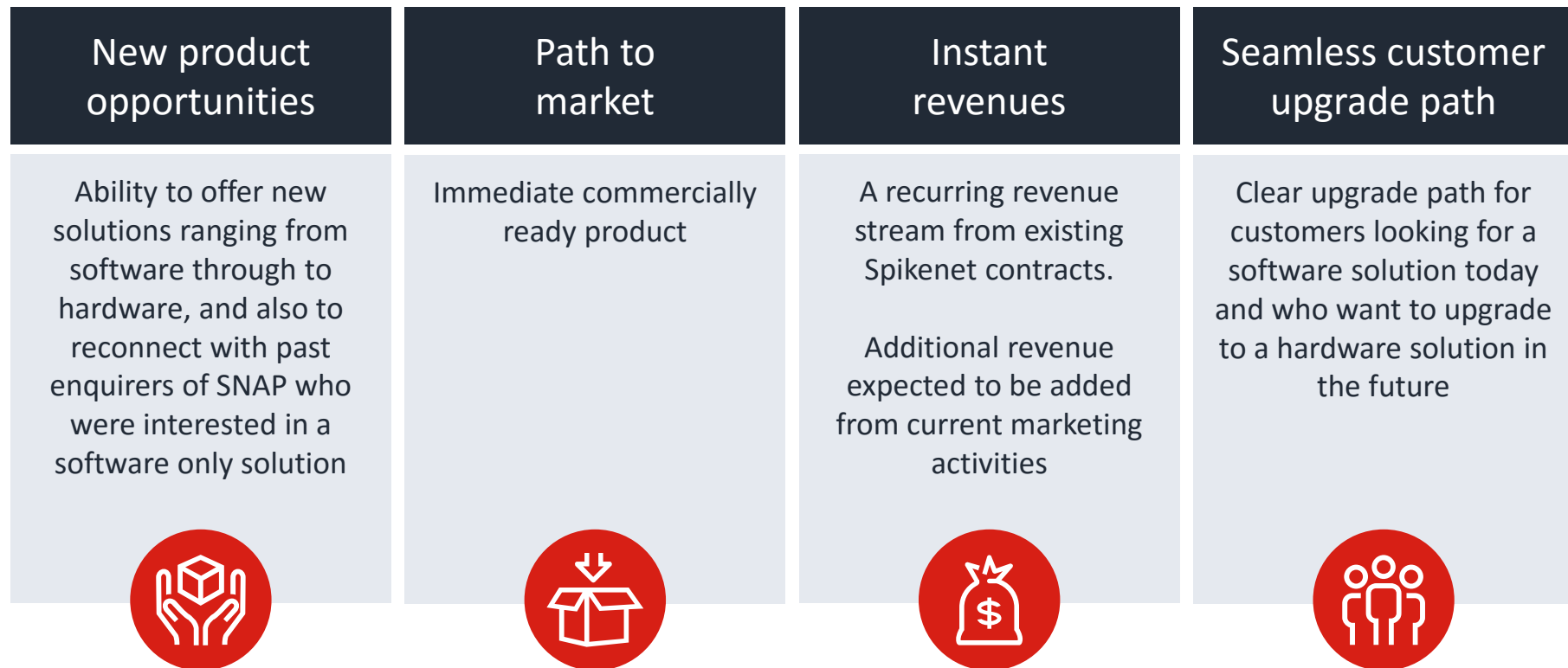


Internet-of-Things (IoT)



Commercial advantages of acquisition

Commercial benefits



Spikenet's commercial contracts

Spikenet will bring immediate revenue to BrainChip through existing commercial contracts

Bordeaux International Airport

- ✧ Spikenet currently has a contract with Bordeaux International Airport. The Spikenet video surveillance is deployed to watch over all aircraft parking stands to detect illicit intrusion.
- ✧ Spikenet reduces false alarms by 80% compared to the previous intrusion detection system that was based only on motion detection, which was prone to giving inaccurate warnings due to movement (i.e. wind).
- ✧ Spikenet is a superior system because it can readily identify a wide range of objects (i.e. people, animals, planes, etc.) and can whitelist and blacklist objects to avoid false alarms.
- ✧ Ongoing maintenance contract with plan to deploy into other areas for use in parking management, left luggage detection and people counting.

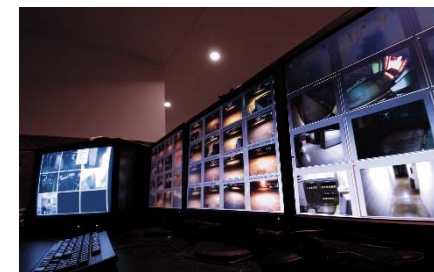


Spikenet's commercial contracts

Spikenet's playing card solution, SPADE, is already in use in a number of Las Vegas casinos

Gaming table surveillance

- ✧ Spikenet currently deploys its SPADE surveillance solution in numerous gaming locations throughout the world including Las Vegas casinos and large cruise ships
- ✧ SPADE has been approved by the Nevada Gaming Board
- ✧ The ready to use solution adds security to casino card games and can also assist with bet tracking and yield management
- ✧ SPADE can be used with any card type, removing the need to change cards or dealing shoes and is cheaper than using an electronic playing card-reader
- ✧ Easy to install and can be quickly fitted to any playing table and any type of card game.



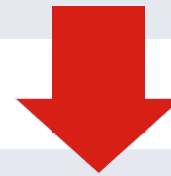
Migration path



Software only

Low risk and low cost entry point for customers to use SNAP

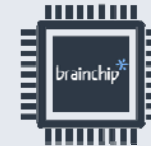
Near term sales opportunities



Hardware only

Total solution chip that can be embedded into phones, cars etc.

Highest performance solution



The Spikenet acquisition provides a low risk entry point for customers not yet ready for a SNAP hardware solution

Experienced team

- ✧ Spikenet brings an experienced team that will assist in the growth of BrainChip
- ✧ Team includes engineers, PhD's, technicians and neuroscientists with a combined 95 years experience
- ✧ Spikenet's team are leaders in their field and bolster an already strong US presence
- ✧ Technical teams now on two major continents that can more readily address or implement local technical solution

Compelling value acquisition

	Spikenet	Nervana Systems	Turi	DeepMind Technologies
Acquired by	BrainChip	Intel	Apple Inc.	Google
Technology	Artificial vision technology based on the human visual system	Intelligent machine learning	Intelligent machine learning platform	Machine learning and visual processing technology
Acquisition price	\$2m	\$400m	\$250m	\$600m
Revenue multiple	<20x	222x	40x	xx
Technology comparison	<ul style="list-style-type: none"> No intensive training required 	<ul style="list-style-type: none"> Uses Deep Learning algorithms requiring intensive training Software and Hardware solutions 	<ul style="list-style-type: none"> Uses Deep Learning algorithms requiring intensive training Software solution 	<ul style="list-style-type: none"> Uses Deep Learning algorithms requiring intensive training

Summary



Merging of complementary technologies offers potential to create the **world's most technically advanced** autonomous learning enabled system



Accelerates **commercialisation opportunities** for BrainChip's SNAP technology



Expands the offering to include software and hardware solutions



Significantly enhances BrainChip's sales pipeline, provides good customers and immediate recurring income

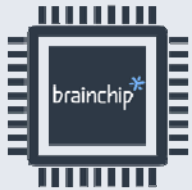


BrainChip can now provide a logical and **seamless upgrade path** for customers moving from software to hardware solutions



Additional technical expertise will assist in accelerating BrainChip's growth

Thank you



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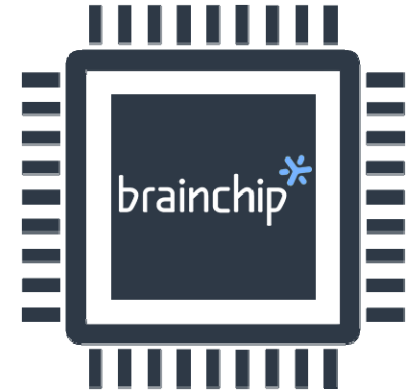
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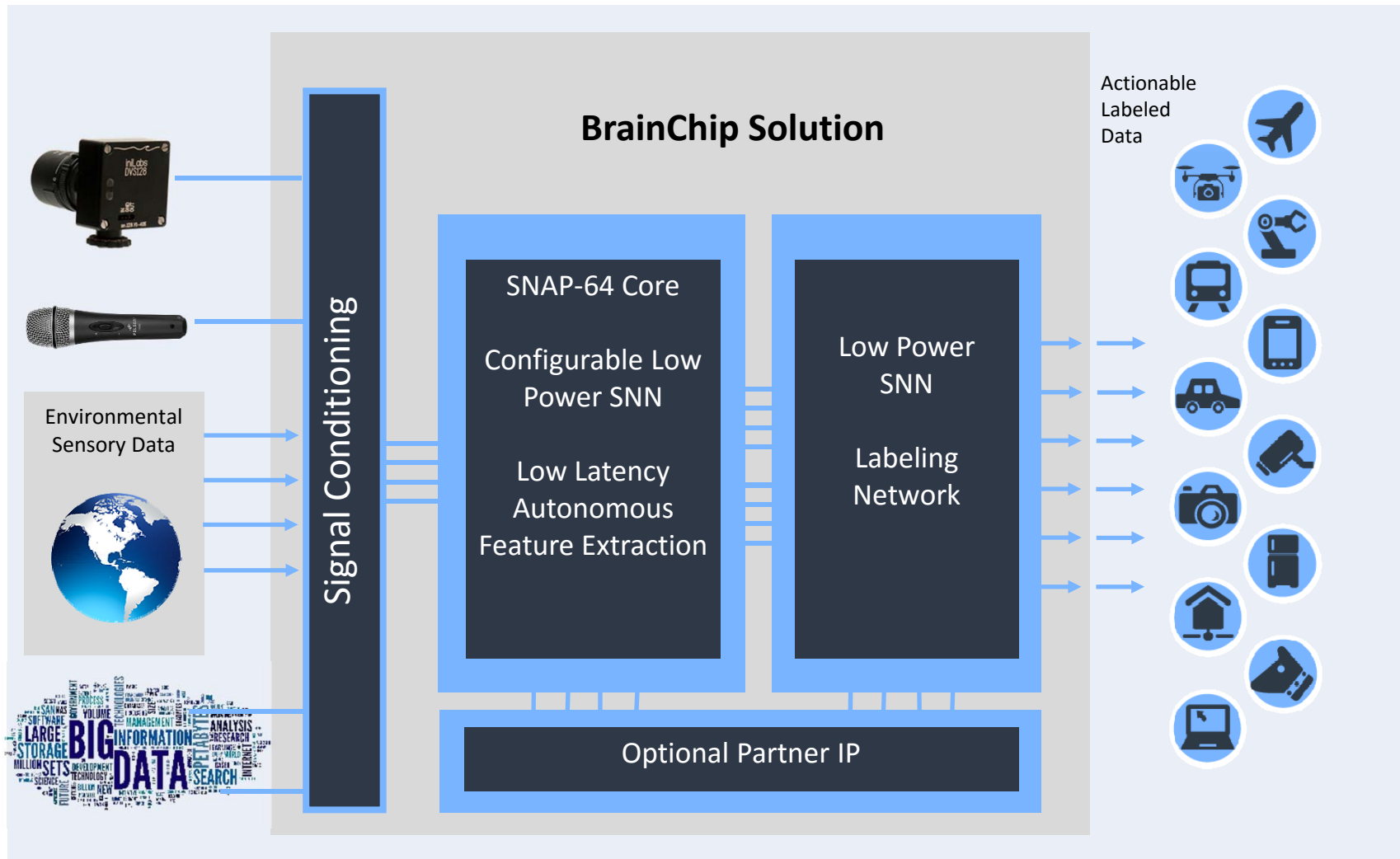
Appendix

SNAP's Unique Features

- ✧ **Next Generation rapid real time learning**, learns autonomously within seconds
- ✧ A revolutionary custom **digital hardware design**, no traditional processing core, no firmware, no external memory
- ✧ **Real time recognition** at very **low latency**
- ✧ **Massive parallel execution** - all neural nodes are updated at the same time, enabling a **speed thousands of times faster than peer software neural networks**
- ✧ Performs **consistently at exceptionally high speed** and does not slow down with network size
- ✧ **Significantly lower power consumption** enables large networks to be integrated into portable devices

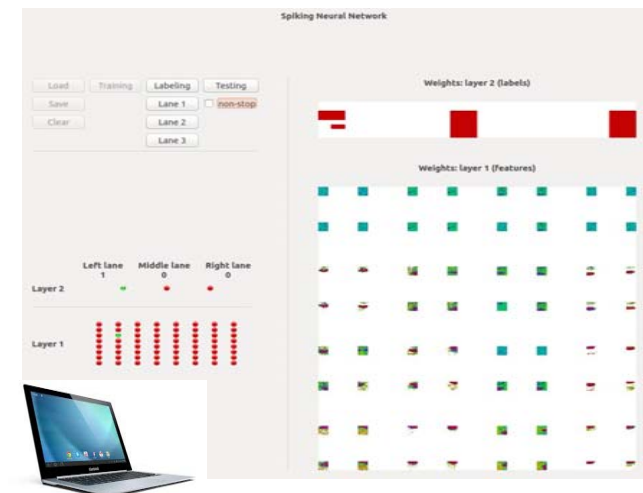
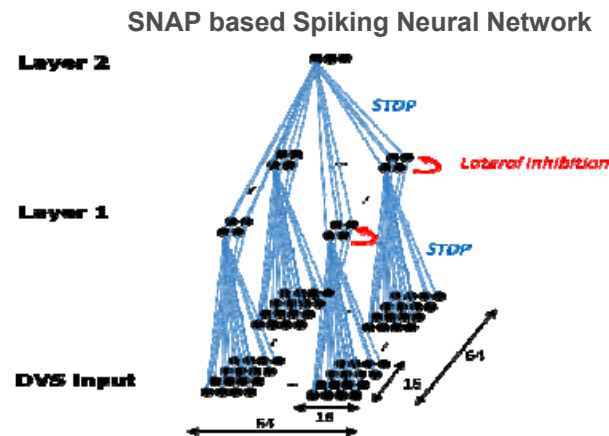
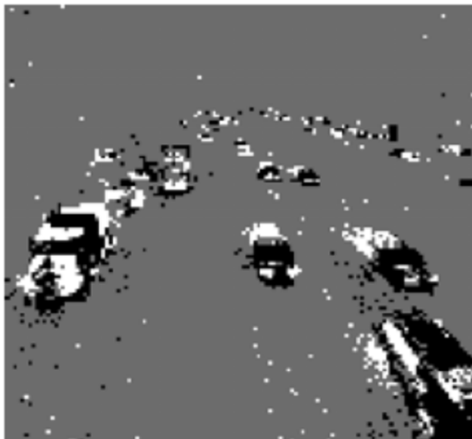


SNAP Solutions Block Diagram



Unsupervised Learning – The New Frontier

- 15 March 2016 – Release of Milestone 3 the Autonomous Visual Feature Extraction Neural Network with a Client / Server Application tool
- Demonstrated SNAP based Real Time Pattern Learning and Recognition working in a chip (FPGA) hardware
- Autonomous and Unsupervised Learning at 1Mhz matching camera time resolution
- [Milestone 3 AVFE Video Demo:](#)



Marketing Strategy - Partners



TECHNOLOGY
RAPID LEARNING NEUROMORPHIC IP

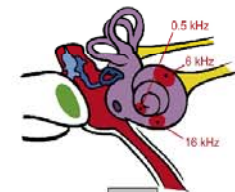
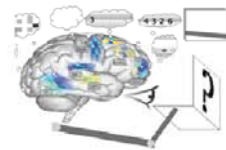
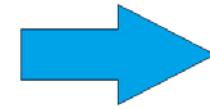


T.B.A. PARTNER

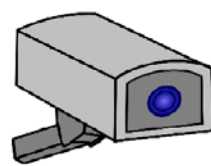
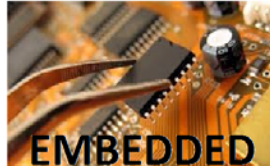
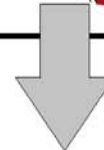
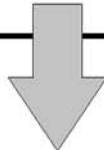
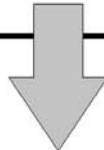
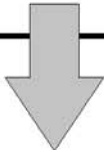
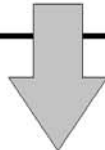
T.B.A. PARTNER



T.B.A. PARTNER



Future Partners...



Projected to reach USD 21.23 billion by 2020
mordorintelligence.com

expected to reach USD 233.13 billion in 2021
transparencymarketresearch.com

expected to reach USD 5.59 Billion by 2020
marketsandmarkets.com

grow from \$2.77 Billion in 2015 to \$6.19 Billion by 2020
marketsandmarkets.com

now worth 1.56 Trillion dollars annually
<http://communities-dominate.blogspot.com/brands/>

from nearly \$39 billion in 2015 to more than \$76 billion in 2020
Researchandmarkets.com