INTRODUCING

the

“LIGHTSPEEER®”

AI Processor

Gyrfalcon Technology Inc.
Company overview

• Founded in 2017 by veteran Silicon Valley entrepreneurs.

Team have combined expertise in ASIC design, memory & storage, and technology to product over the last **30 years**.

Published more than **5,000 paper citations** in AI, memory & storage areas since 1988.

Tier 1 customer devices in production
100+ patents awarded & in-process

**Worldwide Operations**
What Drives Us...

AI Leaders in Consumer Business
Providing the highest performing, lowest power using and lowest priced solutions to drive feasible deployment of Artificial Intelligence at a massive scale.

From IoT End Point to the Cloud
Bringing the benefits of our technology to a diverse range of use cases, providing chipsets, systems and tools to customers that create industry’s leading AI offerings.

Patented & Proprietary Innovation
To lead the market with the most effective technology, leveraging a domain specific architecture enabling application specific designs for leading AI solutions.
PART 02

THE TECHNOLOGY
Our Technology Combines Memory With Processing - Just Like A Real Human Brains
Domain Specific Architecture: Designed From Scratch for AI - Moore’s law is over, DSA is the next AI computing era

Architectures provide industry's best ratio of high performance to low power usage.

1st AI Neural platform to support mixed-load processing using Convolutional Neural Networks.
AI Is A New Form Of Computing, Requires A Domain Specific Architecture...

- **Scalar (0-D)**: CPU (eg. Intel)
- **Vector (1-D)**: GPU (eg. Nvidia)
- **Matrix (2-D)**: MPE™ (only GTI)
  - Scalable Cells
  - Matrix Size: 28,000+ Cores (168 x 168 MACs)
  - Specifically AI Computing

**MPE (Matrix Processing Engine) using APiM (AI Processing in Memory) Architecture:**

- APiM
- APiM
- APiM
- APiM
- APiM
- APiM
- APiM
- APiM

**Interfaces:** (USB3.0/2.0, eMMC4, GPIOs)

**ConStreaming™ Engine**
PART 03

THE PRODUCT
Gyrfalcon’s Vision

- Do more with each generation and family

**Lightspeeur® 2801S (2017)**
- General purpose edge
- Tiny footprint size
- 5.6 TOPS

**Lightspeeur® 2803S (2018)**
- Advanced edge/high performance server
- Small footprint size
- Model cascade mode
- 16.8 TOPS

**Next-Gen Lightspeeur® 2802M (2018)**
- Advanced edge
- MRAM technology
- Small footprint size
- Multi-model chip
- Low power leakage

**Future Gens (2019 3 chips)**
# Lightspeeur® 2801S Introduced for Customers Designing Edge AI Devices

<table>
<thead>
<tr>
<th>Verticals</th>
<th>Use Case Examples:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise</td>
<td>• Office Products</td>
</tr>
<tr>
<td></td>
<td>• Smart Office</td>
</tr>
<tr>
<td></td>
<td>• Data Center</td>
</tr>
<tr>
<td></td>
<td>• Surveillance</td>
</tr>
<tr>
<td></td>
<td>• Access/Entry</td>
</tr>
<tr>
<td></td>
<td>• Asset tracking</td>
</tr>
<tr>
<td>Industrial</td>
<td>• Robots &amp; Drones</td>
</tr>
<tr>
<td></td>
<td>• Process Automation</td>
</tr>
<tr>
<td></td>
<td>• Defect Detection</td>
</tr>
<tr>
<td></td>
<td>• Logistics Management</td>
</tr>
<tr>
<td>Consumer</td>
<td>• Smart Home</td>
</tr>
<tr>
<td></td>
<td>• Computing Devices</td>
</tr>
<tr>
<td></td>
<td>• Entertainment</td>
</tr>
<tr>
<td></td>
<td>• Sport/Fitness</td>
</tr>
<tr>
<td></td>
<td>• Home Security</td>
</tr>
<tr>
<td>Government</td>
<td>• Smart City</td>
</tr>
<tr>
<td></td>
<td>• Surveillance &amp; Security</td>
</tr>
<tr>
<td></td>
<td>• Traffic &amp; Resource Management</td>
</tr>
</tbody>
</table>

© 2017-2018 Gyrfalcon Technologies, Inc.
Comparisons with market leading AI Engine

- SPR2801S maxes performance with super power-consumption.

<table>
<thead>
<tr>
<th></th>
<th>SPR2801S</th>
<th>Nvidia Tegra X2</th>
<th>CEVA XM6 DSP SOC</th>
<th>Qualcomm Hexagon 685</th>
<th>Mobileye EyeQ4</th>
<th>Movidius Myriad X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock (MHz)</td>
<td>50</td>
<td>1,300</td>
<td>600</td>
<td>1,600</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Performance (TOPS)</td>
<td>2.8</td>
<td>1.3</td>
<td>0.6</td>
<td>2.1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>Power (W)</td>
<td>0.3</td>
<td>6.5</td>
<td>1.0</td>
<td>1.0</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Efficiency (TOPS/W)</td>
<td>9.3</td>
<td>0.2</td>
<td>0.6</td>
<td>2.1</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Technology (nm)</td>
<td>28</td>
<td>16</td>
<td>28</td>
<td>10</td>
<td>28</td>
<td>16</td>
</tr>
</tbody>
</table>
Lightspeeur® 2803S Highest TOPS for Advanced Edge & Cloud AI...

Additional Specs & Capabilities:
- 448 x 448 x 4 (RGB + 3D) Image Sizes
- 24.0 TOPS/W
- 16.8 TOPS @ 700 mW
- Neural Networks: ResNet, MobileNet, ShiftNet, VGG & SSD
- Cascading capability: Very large models via multi-chip packaging
PART 04 THE SOLUTION
Vision Solutions

Image Classification

Object Detection

Semantic Segmentation

Pre-defined Detection

Video Segmentation

Human Pose Detection
Image/video Processing Solution

- **Super Resolution**
- **Low Light HDR**
- **Style Transfer**
- **Video Bokeh**
Image/video Processing Solution
- lowlight enhancements
Voice/Speech Solution

Wake-on Voice authentication

Speech Recognition

Natural Language Process
PART 04

Applications
AI specific hardware – First Generation

SPR2801S AI module: 22TOPS x 16 CPU card = 352 TOPS
All CPU cards are connected via Socionext DDT
AI specific hardware – Second Generation (PCIe)

1000x efficiency

- Matrix Neural Processor
  High performance
  @32PEC 192 x 24T = 4608TOPS
Compact descriptors for video analysis for search and retrieval applications:

1. Enable design of interoperable object instance search applications
2. Minimize size of video descriptors
3. Ensure high matching performance of objects
4. Enable efficient implementation of functionalities on systems.

**Approved Neural Network Compression:**

- VGG16
- CDVS: MPEG-7 Part 13
- CDVA: MPEG-7 Part 15
- NNR: MPEG 7 Part 17

---

<table>
<thead>
<tr>
<th>Title</th>
<th>White Paper on CDVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Communication</td>
</tr>
<tr>
<td>Status</td>
<td>Approved</td>
</tr>
</tbody>
</table>

**Compact Descriptors for Visual Analysis (CDVA) – Efficient Search in Large-scale Video Content**

Managing and organizing the quickly increasing volume of video content is a challenge for many industry sectors, such as media and entertainment or surveillance. One example task is scalable instance search, i.e., finding content containing a specific object instance or location in a very large video database. This requires video descriptors which can be efficiently extracted, stored and matched. Standardization enables extracting...
Visual Search Example....

Search Query
(from camera, photo gallery, application...)

Search Results
(from broadcast archives, service providers...)

4/3/2019
# Search Results: Traffic Results

## Visual Input

<table>
<thead>
<tr>
<th>City Bus</th>
<th>Traffic Signal</th>
<th>Pick-Up Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="City Bus" /></td>
<td><img src="image2.png" alt="Traffic Signal" /></td>
<td><img src="image3.png" alt="Pick-Up Truck" /></td>
</tr>
</tbody>
</table>

## Top Search Results

<table>
<thead>
<tr>
<th>First</th>
<th>Second</th>
<th>Third</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="First Result" /></td>
<td><img src="image5.png" alt="Second Result" /></td>
<td><img src="image6.png" alt="Third Result" /></td>
</tr>
</tbody>
</table>

*Top1 Timestamp: 00:00:06:560*

*Top2 Timestamp: 00:00:17:000*

*Top3 Timestamp: 00:00:28:500*

- 4/3/2019

Gyrfalcon Technology Inc. All Rights Reserved
# 2801 Search Results: Street Images

## Visual Input

<table>
<thead>
<tr>
<th>Search Target</th>
<th>Visual Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronze Statue</td>
<td><img src="image1.jpg" alt="Bronze Statue" /></td>
</tr>
<tr>
<td>Umbrella</td>
<td><img src="image2.jpg" alt="Umbrella" /></td>
</tr>
<tr>
<td>Woman in White Jacket</td>
<td><img src="image3.jpg" alt="Woman in White Jacket" /></td>
</tr>
</tbody>
</table>

## Top Search Results

<table>
<thead>
<tr>
<th>First</th>
<th>Second</th>
<th>Third</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.jpg" alt="First Image" /></td>
<td><img src="image5.jpg" alt="Second Image" /></td>
<td><img src="image6.jpg" alt="Third Image" /></td>
</tr>
<tr>
<td><img src="image7.jpg" alt="First Image" /></td>
<td><img src="image8.jpg" alt="Second Image" /></td>
<td><img src="image9.jpg" alt="Third Image" /></td>
</tr>
<tr>
<td><img src="image10.jpg" alt="First Image" /></td>
<td><img src="image11.jpg" alt="Second Image" /></td>
<td><img src="image12.jpg" alt="Third Image" /></td>
</tr>
</tbody>
</table>

*4/3/2019*
Sample Video
Colaboration with Linaro

- Open SDK integration in Arm NN and offer to public
- Optimize NN supported currently on Gyrfalcon SDK
- Define middleware and SDK
- Hardware/driver level support
Thank You!