Leopard DPU

A new chapter in on-board data processing

A high-performance AI computer

ABOUT **LEOPARD**

Leopard is a CubeSat standard compliant Data Processing Unit which enables mission designers to apply Artificial Intelligence solutions in space. It was designed to support capturing, managing and processing of data in orbit.

Leopard redefines the current approach to remote sensing. Now, instead of sending huge, unprocessed sets of data to ground stations, Leopard uses **Deep Neural Networks** to process data on-board and therefore only sends the most important and valuable insights to the ground. By reducing the time and cost of data transfer and processing, it enables you to focus on a rapid response to any detected phenomena.

Leopard is integrated with a powerful FPGA to accelerate execution of deep learning algorithms and has a throughput of up to **3 Tera Operations Per Second**. A number of hardware and software measures protect the computer against the influence of radiation.

With its small size (**1U form factor**), wide voltage range and universal interfaces, it is compatible with most CubeSats platforms. Its scalable and customisable architecture makes it possible to create larger and more powerful versions dedicated to bigger platforms as well.

APPLICATIONS

Leopard was designed to resolve problems when real-time data analysis is crucial.

Image segmentation and object detection

Signal quality enhancement

Data compression and encryption

Spacecraft autonomy

Optical navigation

And many more!

KEY **ADVANTAGES**

1 **Huge processing power** in a small form-factor.

- Using powerful FPGAs to accelerate execution of deep learning algorithms.

2 **Artificial Intelligence** available on board.

- Processing data directly in orbit using Deep Neural Networks.
- Using the most popular ML libraries such as Cafe or TensorFlow.

3 **Freedom, flexibility and security** of the mission.

- Implementing an open-source operating system (Linux).
- Uploading multiple Neural Network models prior to the launch as well as during the mission.
- Applying single cell memory and rad-tolerant design.

TECHNICAL SPECIFICATION

PROCESSING CORES	Zynq UltraScale+ MPSoC ZU2EG/ZU4EG/ZU9EG/ZU15EG ◆ 4 x ARM A53 CPU 800 – 1000 MHz ◆ ARM R5 lock-step CPU ◆ FPGA architecture for custom function implementation
MEMORY	◆ 4-16 GiB DDR4 providing Error Detection and Correction (EDAC) ◆ 4-16 GiB SLC flash-based filesystem storage (EDAC)
ADDITIONAL MEMORY	◆ Up to 2x128 GiB SLC flash-based data storage
INTERFACES	◆ Control Interfaces: CAN, GPIO ◆ Data Interfaces: High-Speed LVDS, SPI, RS422/485 ◆ Additional custom interfaces upon request
SPECIFICATIONS	◆ A radiation hardened Payload Controller ◆ Voltage from +6.5 to +14 V ◆ Power Consumption from 7.5 W to 40 W depending on workload and specified processing speed ◆ Computational Throughput for Neural Networks Processing up to 3 TOPS ◆ Operating Temperature 0 – 90 °C ◆ Radiation Tolerance (TID) > 20 kRad (Si) ◆ Thermal interface customisable for satellite architecture
SOFTWARE ECOSYSTEM	◆ 64-bit Linux ◆ Deep Learning Accelerator fed with Caffe or TensorFlow models ◆ FPGA reconfigurable in orbit
REDUNDANCY	◆ Possibility to introduce additional redundancy to each version
FORM-FACTOR	◆ 1 U

INTUITION-1 MISSION CASE STUDY

Leopard will be utilized by the Intuition-1 satellite, coupled with a 150-band hyperspectral sensor to perform image segmentation and object detection. For the purpose of on-board data processing during the mission, we will use two high performance ZU15EG nodes for redundancy and parallel operation.

ABOUT US

KP Labs is a NewSpace company based in Poland. The mission of KP Labs is to accelerate space exploration by supporting deep space exploration with enhanced spacecraft autonomy and technologies including hyperspectral imaging instruments and high-efficiency Data Processing Units. The company has the status of a Research and Development Center and is a member of the FP Space consortium, along with In Space Services, FP Instruments and Future Processing.

Our company is a team of 40 engineers who do not think that the sky is the limit.

SOUNDS GOOD?

Contact us at info@kplabs.pl to reach the benefits your organization deserves!

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