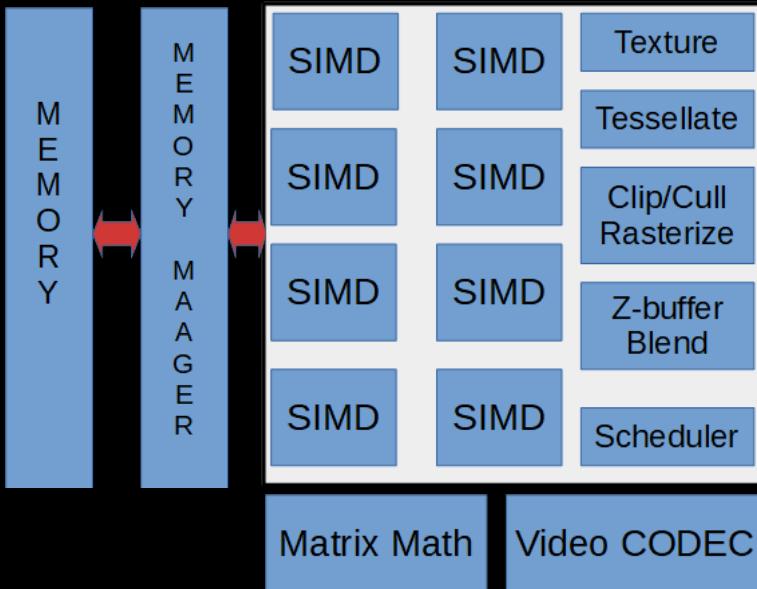


A grayscale close-up photograph of two human eyes looking directly at the viewer. The eyes are framed by dark eyelashes and skin. The background is slightly blurred.

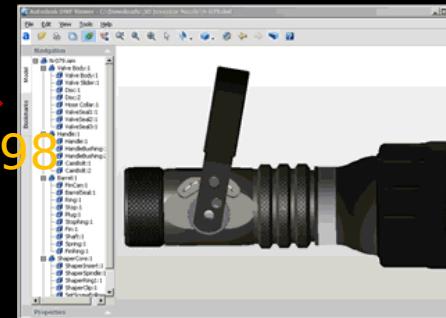
# GPUS and VISUAL COMPUTING

*The challenges getting machines to understand  
what they see*

# GPUs were designed for CAD and games



3Dlabs 1998  
Multi-chip



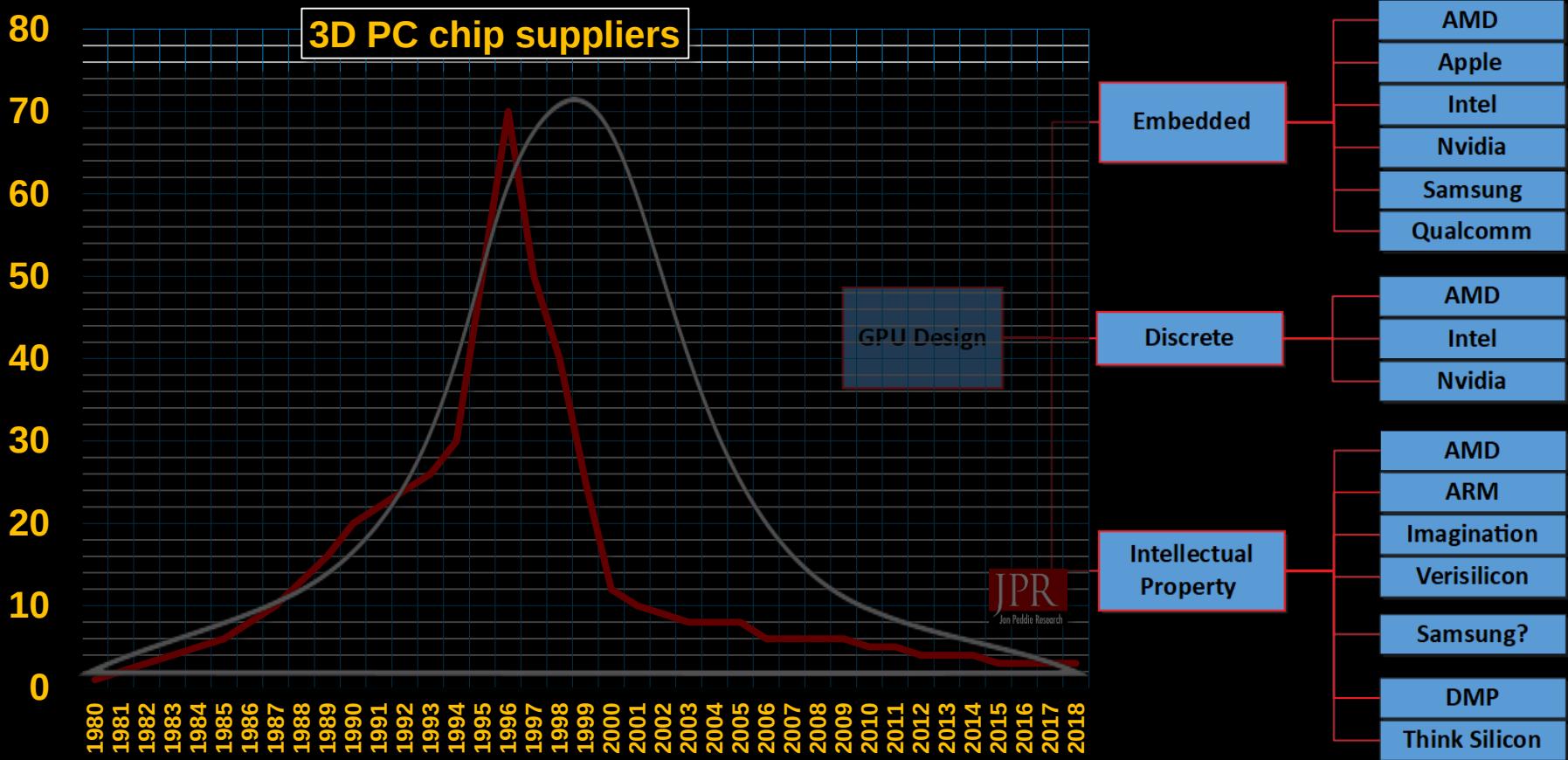
Nvidia 1999  
Single chip



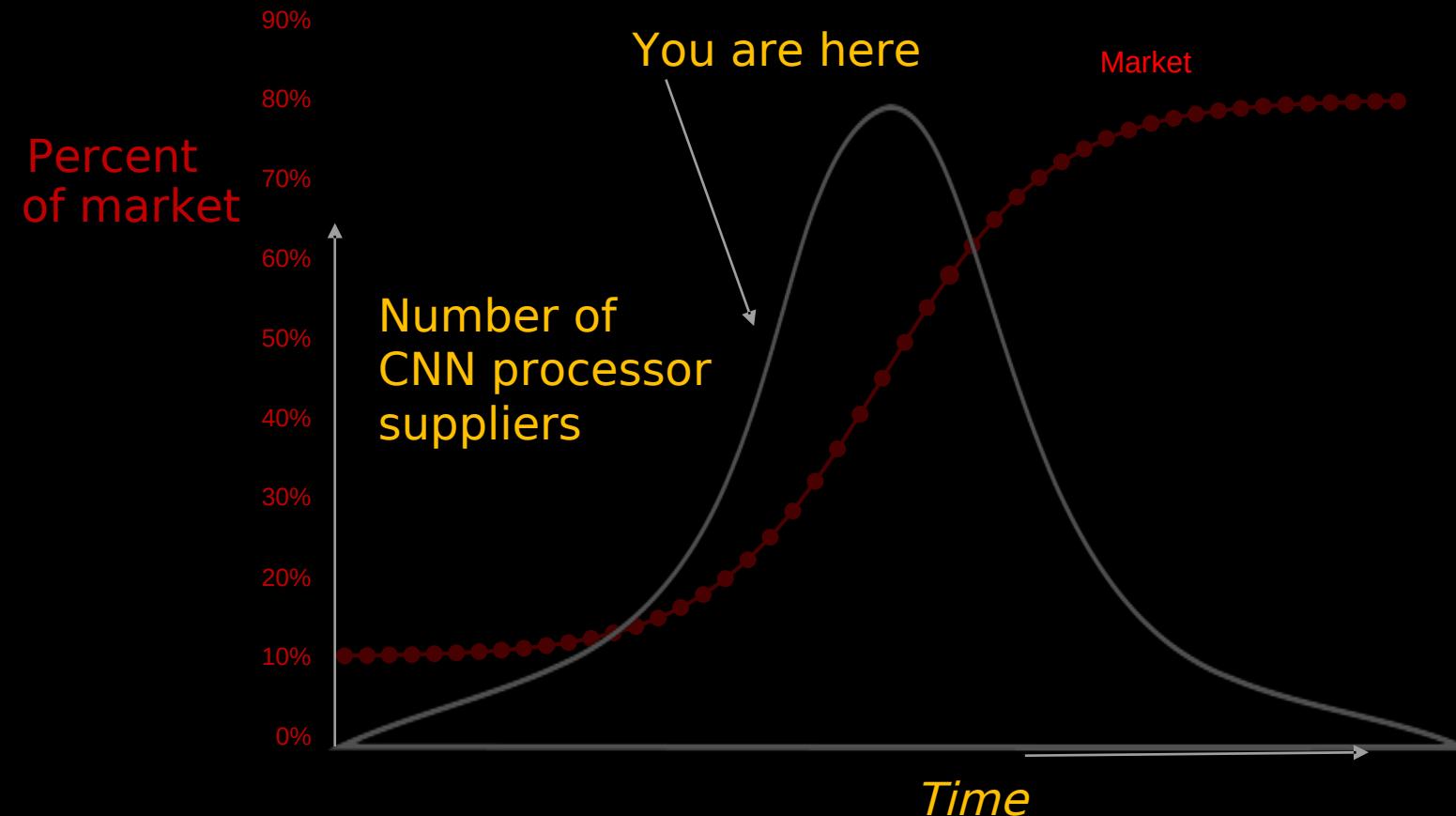
And then image processing and video,  
and then photo and video editing,  
and then simulation and visualization

~ 2 M pixels

# GPUs - a little taxonomy



# History's Lesson – a Gaussian temporal distribution



# While GPU applications and platforms expanded



From gaming



To instrumentation,



Cockpits,

mobile devices,



robots that can see,



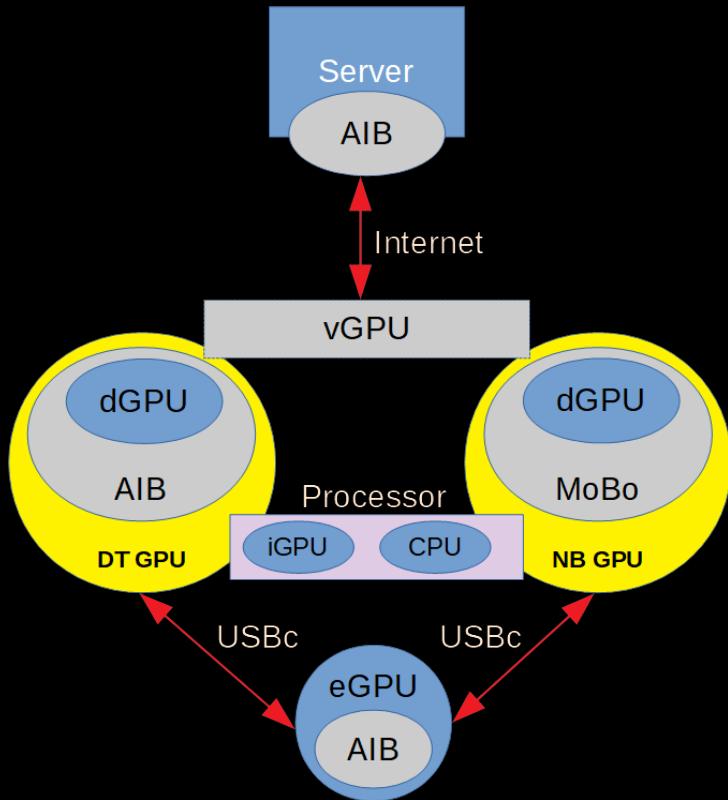
autonomous vehicles,



and compute



# The GPU became so ubiquitous we needed to add a prefix to identify it



**dGPU** — the basic, discrete (stand-alone) processor that always had its own private high-speed (GDDR) memory. dGPUs are applied to AIBs and system boards in notebooks.

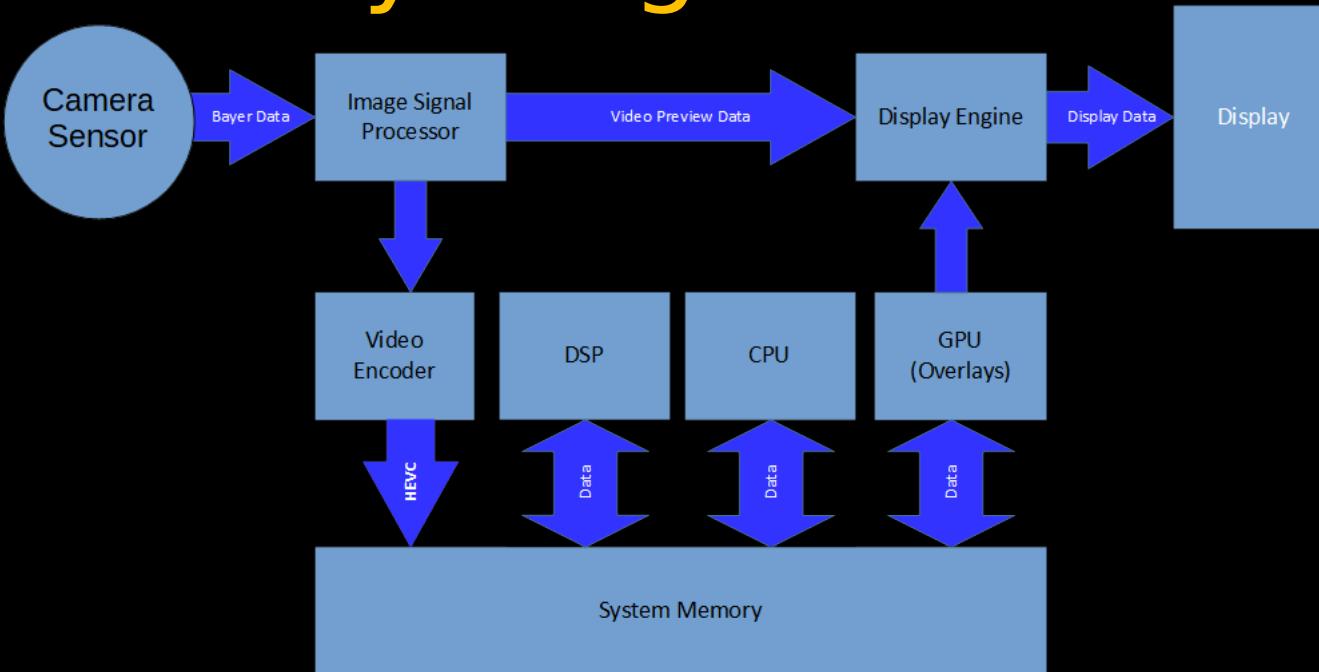
**iGPU** — a scaled down version, with fewer shaders (processors) than a discrete GPU which uses shared local RAM (DDR) with the CPU.

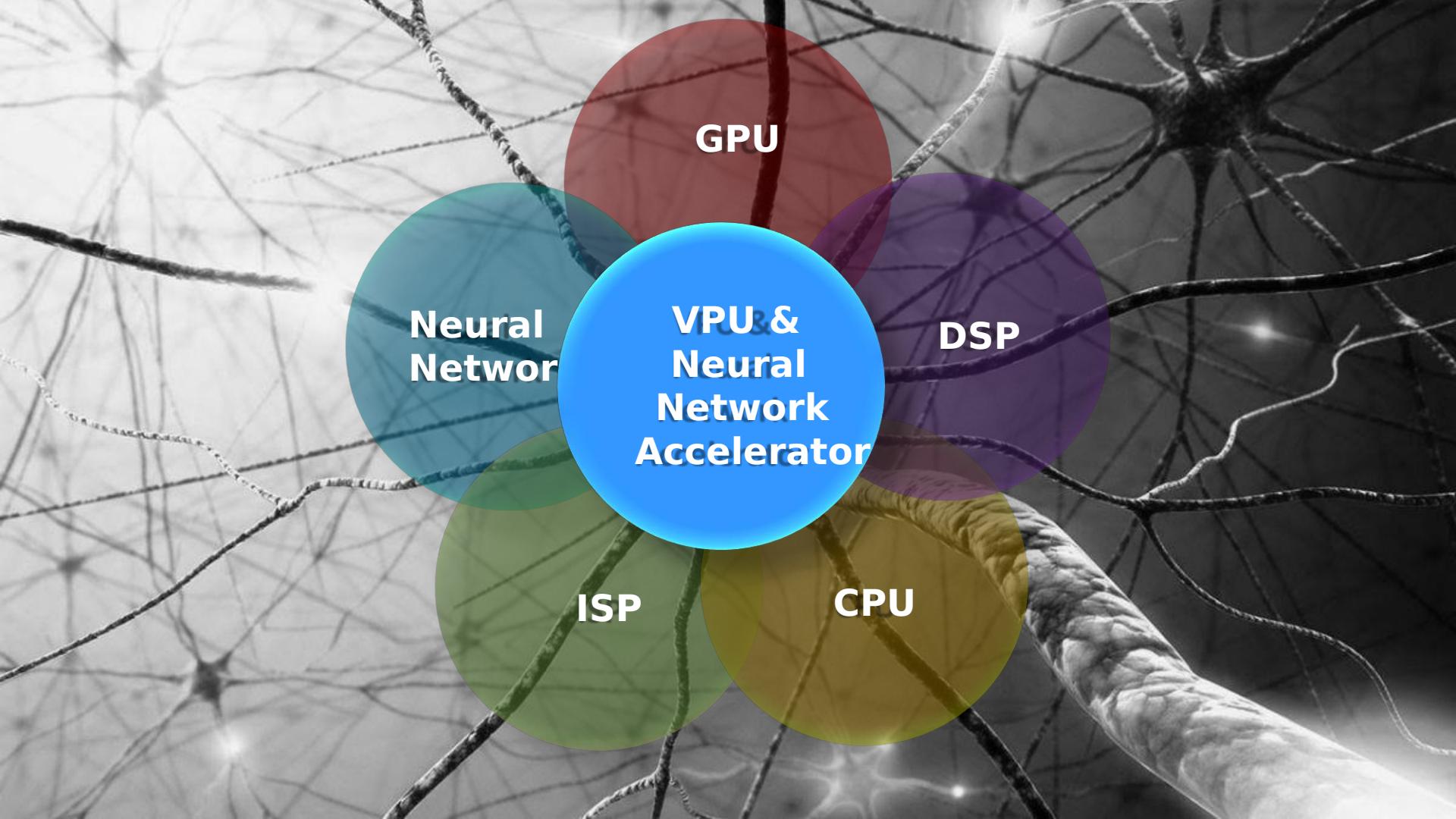
**vGPU** — an AIB with a powerful dGPU located remotely in the cloud or a campus server.

**eGPU** — an AIB with a dGPU located in a stand-alone cabinet (typically called a breadbox) and used as an external booster and docking station for a notebook

# Vision systems exploiting GPUs

## It uses everything





**VPU &  
Neural  
Network  
Accelerator**

**GPU**

**Neural  
Networ**

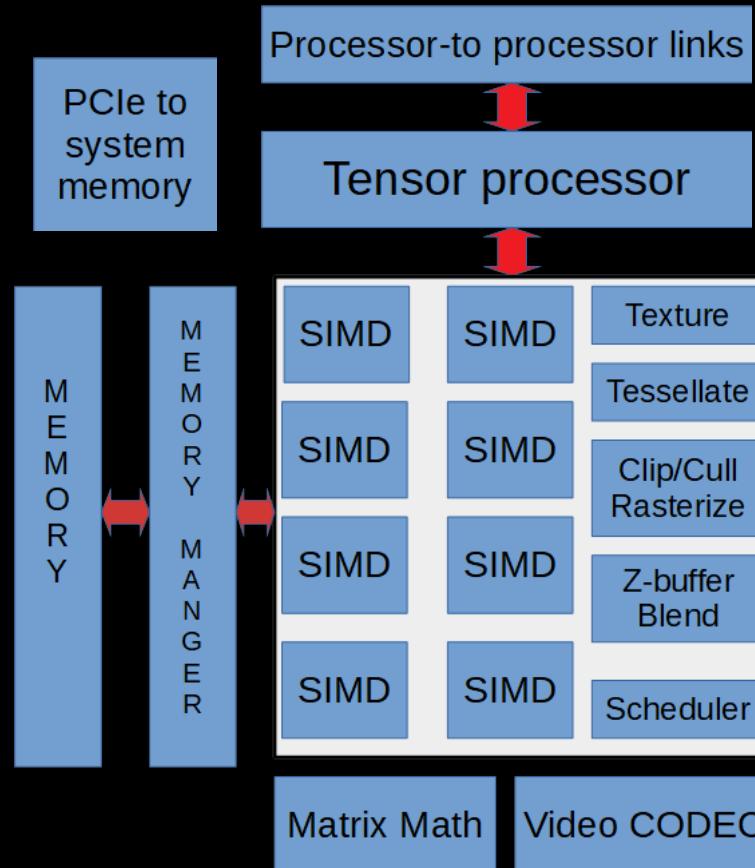
**DSP**

**ISP**

**CPU**

# Which takes the GPU into ML & AI

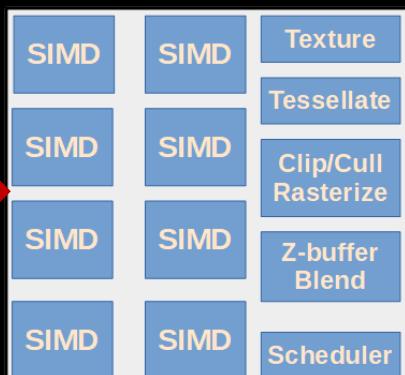
And demonstrates the incredible versatility and extensibility of the GPU



# Spot the Alien: Identify the Correct Extraterrestrial (ICE)



GPU



? Using GPUs, and AI to  
make classifications faster  
And more accurate

Use the processing power of GPU to take camera input, run it through multiple CNNs and abstract objects

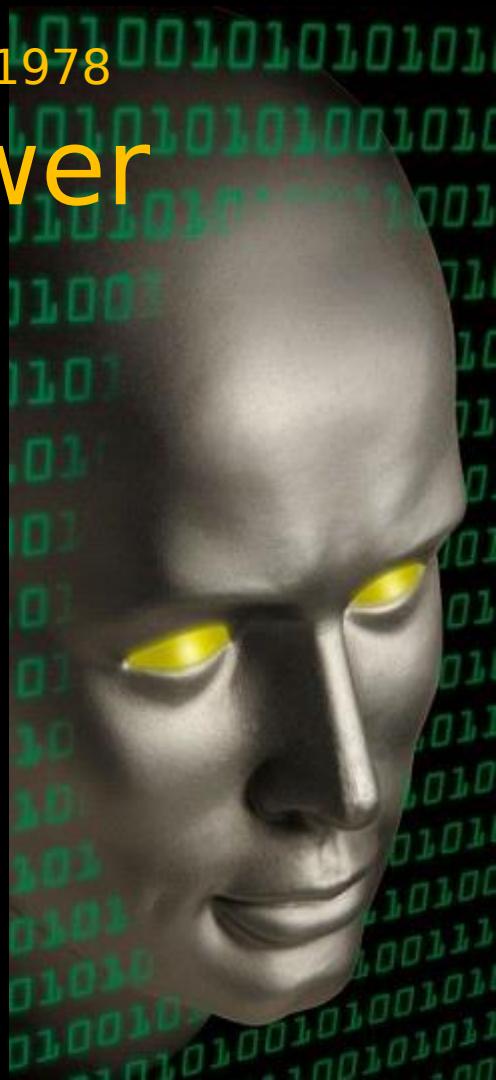
In Computer Graphics, too much is not enough - JP, 1978

# Processing Power

The human brain can process  
entire images that the eye sees  
for as little as 13 milliseconds  
 $>580\text{ M pixels}$



In Computer Vision There Is Never Enough



# Summary

There is an enormous demand for smart computer vision systems

The data analysis is gigantic and can't be done without the cloud

Smart cameras, with AI, and big reservoirs of data will anticipate and learn making life safer and more comfortable

Chasing pixels - *finding Visual Magic*



...Be Seeing You