



Embedded Computing *without* Compromise



***“The Future is Now!”***

# ***AI in Military & Industrial Applications***

Embedded Tech Trends, January 2019

# AI in Military & Industrial Applications

- ✦ Artificial Intelligence vs Machine Learning vs Deep Learning
- ✦ Deep Learning and Neural Networks
- ✦ Image processing and GPGPU
- ✦ Supercomputers and AI systems
- ✦ Where technology is being used now and into the future

Artificial Intelligence

Machine Learning

*Evolutionary*

*Probabilistic*

*Inductive*

*Kernel*

Deep Learning



# What is Deep Learning?

Deep Learning is a subset of AI (Artificial Intelligence) and Machine Learning

It uses multi-layered artificial neural networks to deliver state-of-the-art accuracy in

- object detection
- speech recognition
- language translation
- many more tasks



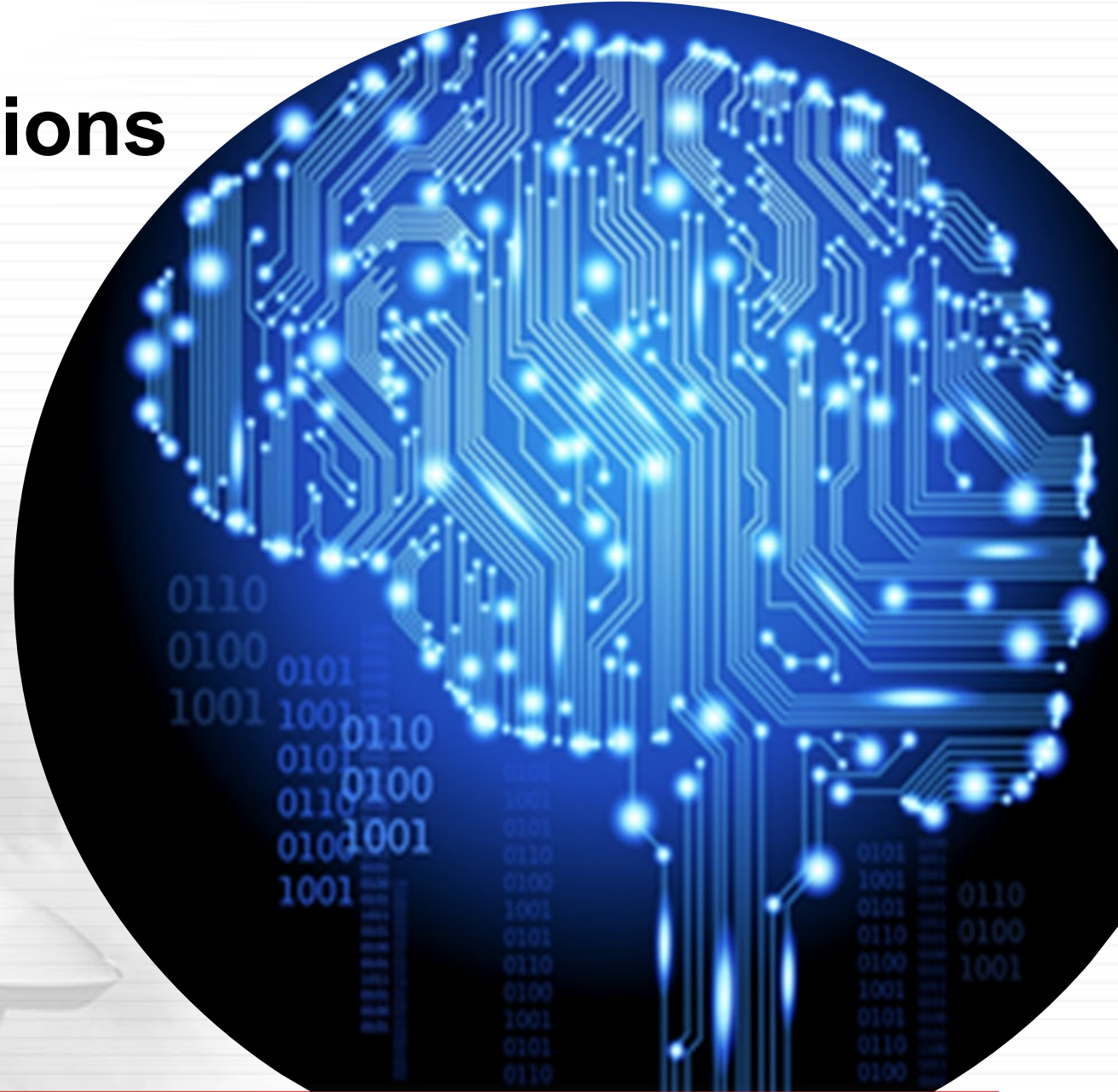
Aitech Defense Systems, Inc.

A member of the Aitech Rugged Group

Embedded Computing without Compromise

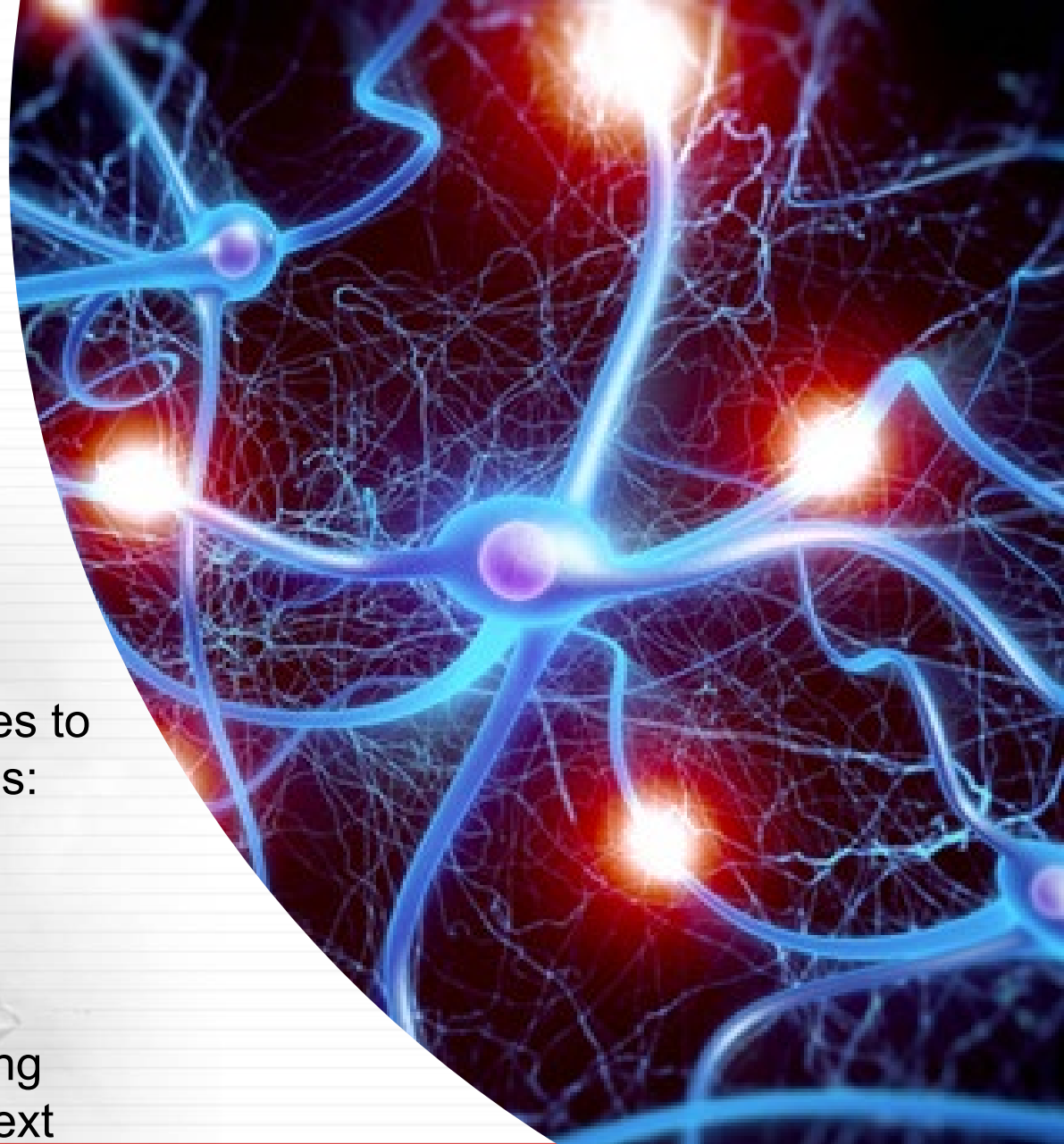
# Deep Learning Definitions

- DNN – Deep Neural Network
- NVIDIA DIGITS – Deep learning GPU Training System: web application for training deep learning models
- CUDA<sup>®</sup> – Parallel computing platform and programming model developed by NVIDIA for general computing on graphical processing units (GPGPU)



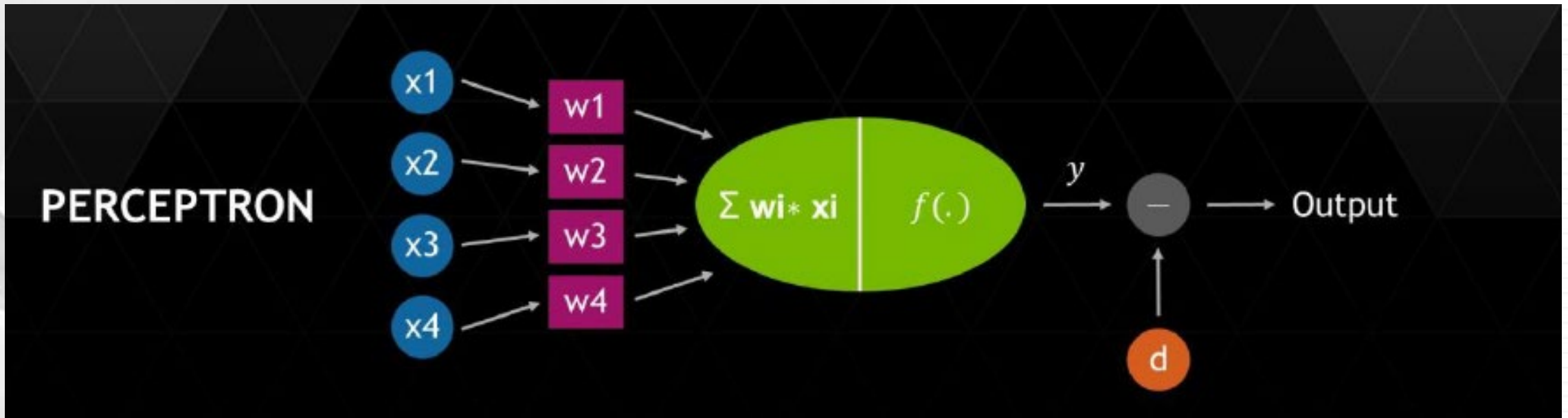
# Deep Learning & Neural Networks

- Computing based on deep learning models (brain's neural learning process) provides:
  - Continuous learning
  - Increased intelligence over time
  - Delivering more accurate, faster results
- NVIDIA CUDA model uses deep learning capabilities to address complex computing problems, and provides:
  - Parallel computing platform
  - Application programming interface (API)
  - Training in object recognition and classification
  - Increased intelligence and efficiency in identifying basic and complex objects, plus assigning context



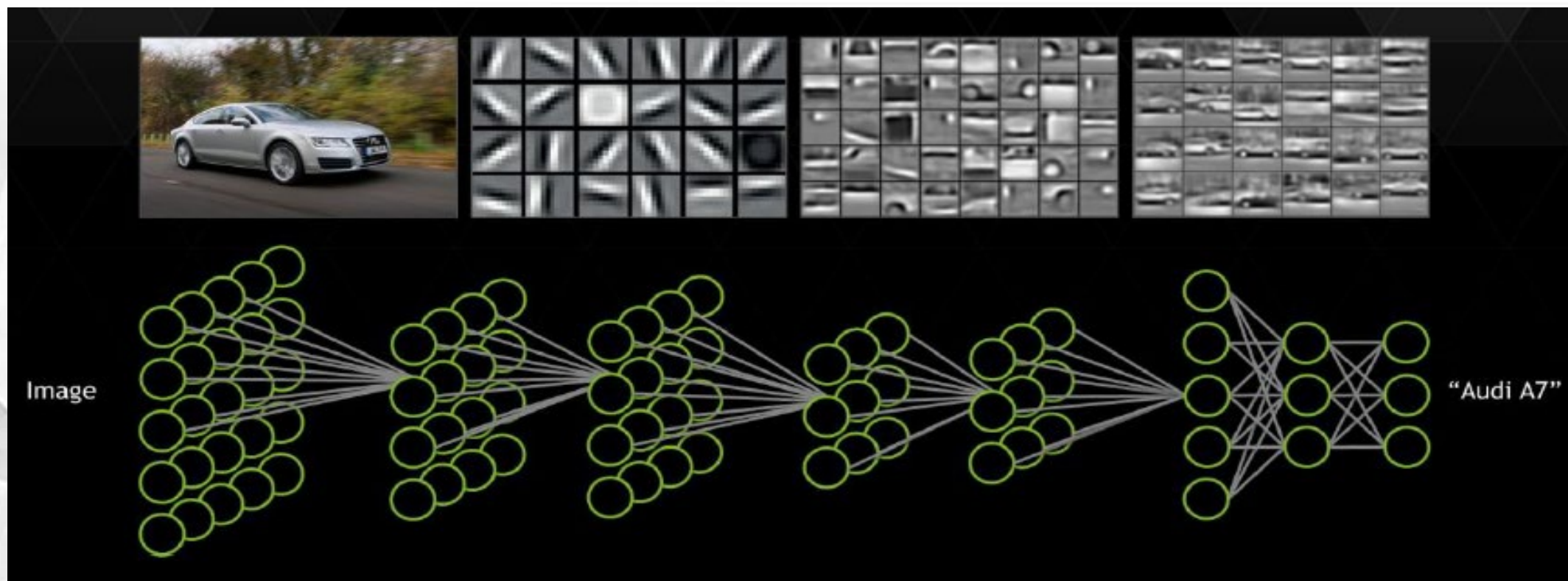
# Deep Learning & Neural Networks

- The Perceptron is the most basic neural network model
- It has several inputs that represent various object features that it's being trained to recognize and classify
- Each feature is assigned a certain weight, based on importance in defining the shape of that object



# Deep Learning & Neural Networks

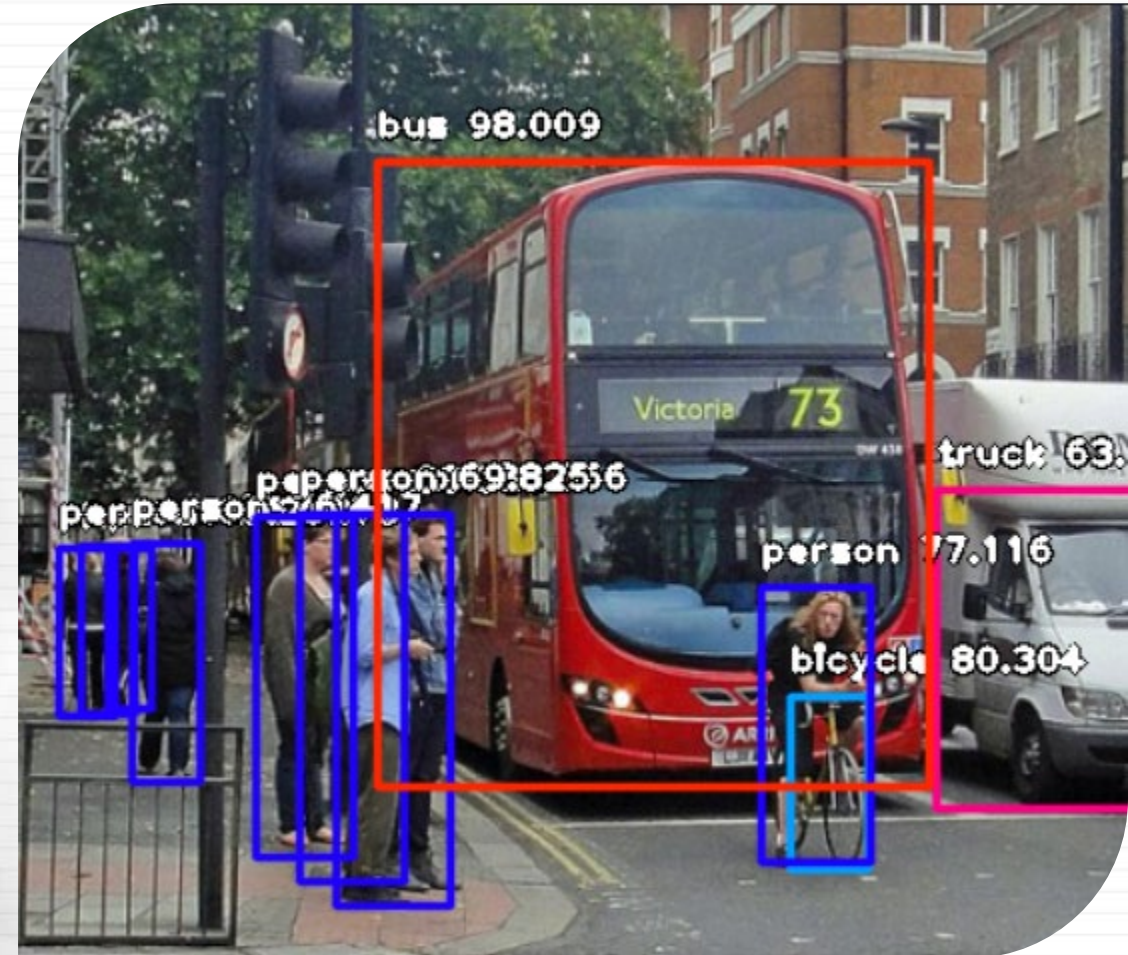
- Multi-layered neural network model may consist of several interconnected, complex Perceptron-like nodes
- Each node looks at many input features and feeds its output to several other nodes, for example:



# Image Processing Tasks

Tasks generally require heavy-duty calculation power:

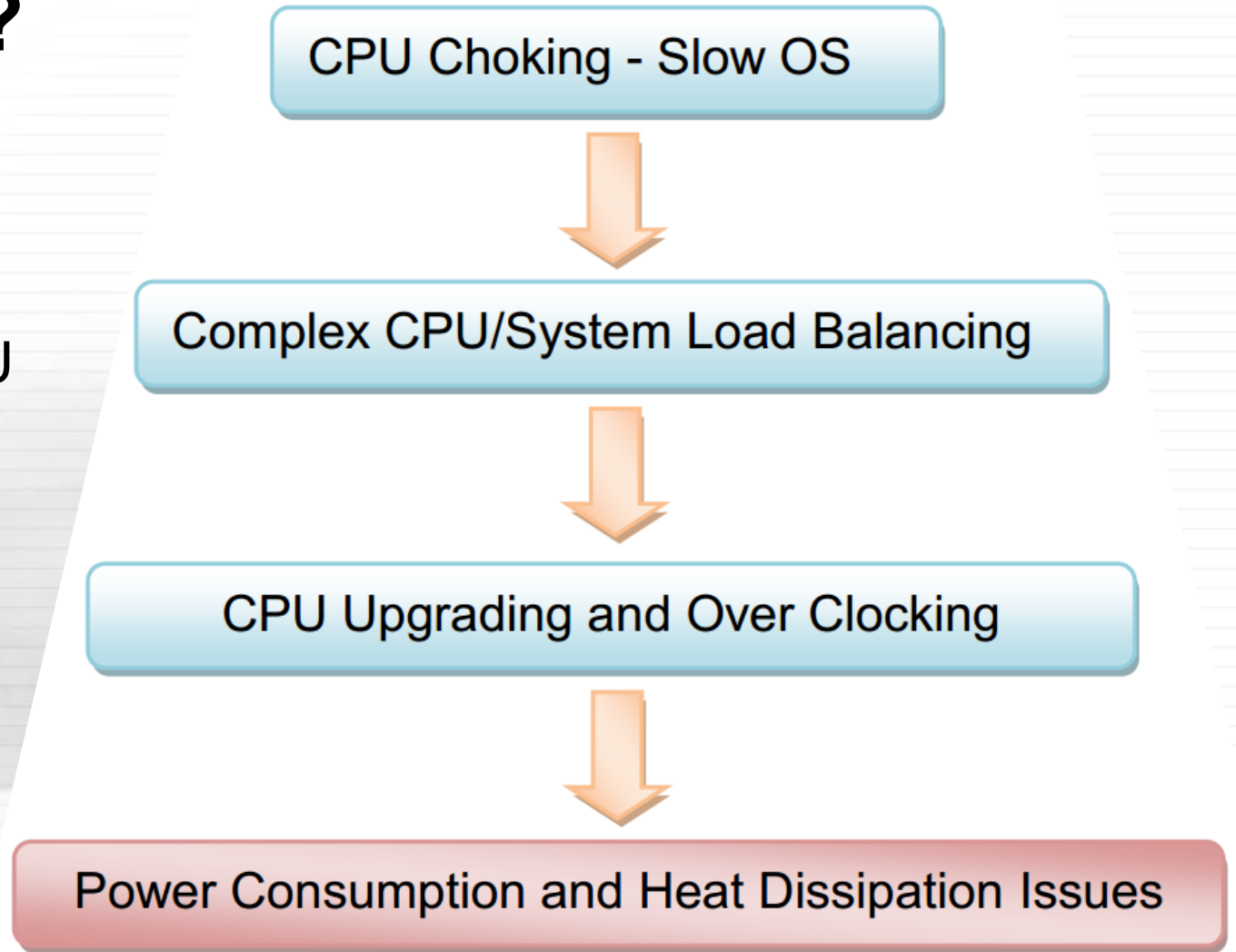
- Image Classification - pattern or object recognition and identifying classes
- Image Location - locating and extracting image coordinates, finding where in the video those objects are located
- Image Segmentation - locate objects boundaries lines, curves, etc. in images/video





# Why use GPGPU?

- ⊕ These kinds of calculations are too much for a conventional CPU
- ⊕ Perfect candidates for deploying NVIDIA deep learning inference networks using hundreds of parallel CUDA cores



# Why use GPGPU?

CPU-Only Inferencing



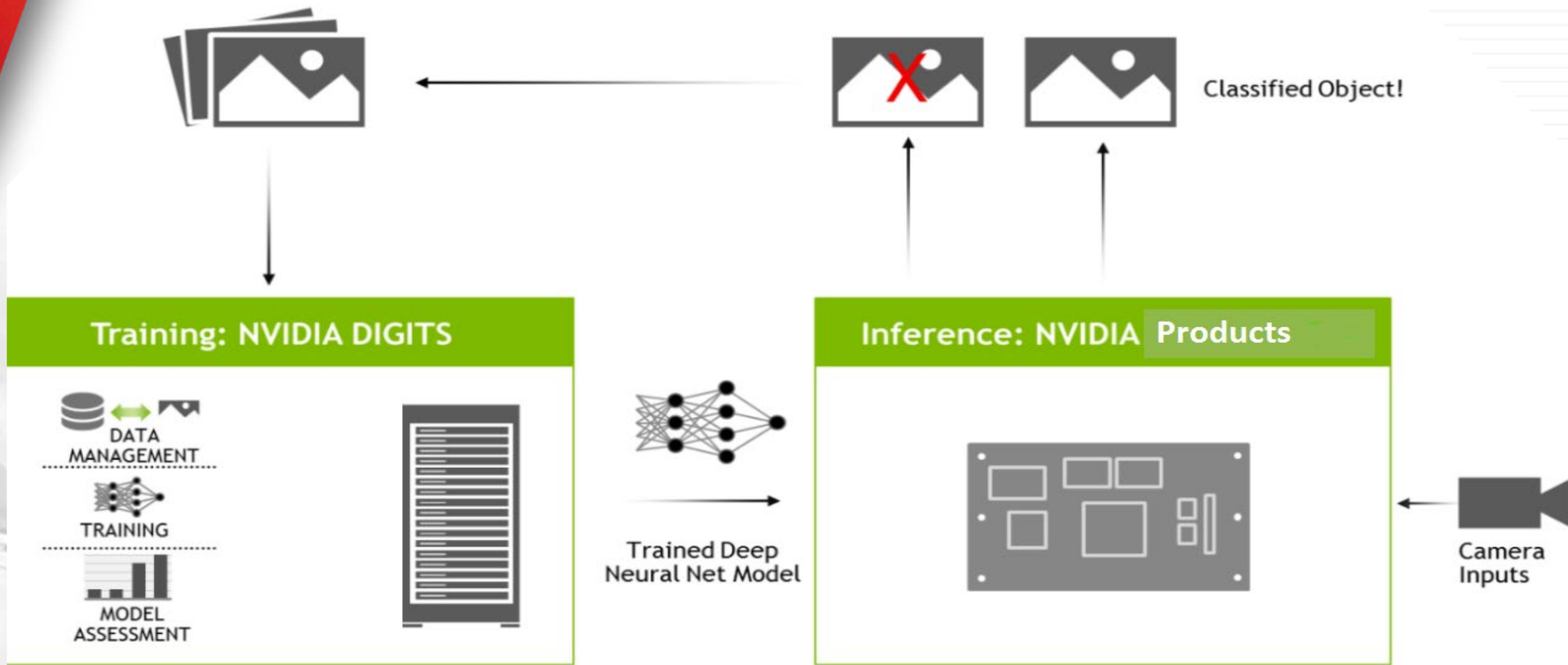
Images Per Sec: 5

Inferencing with NVIDIA Tesla V100



Images Per Sec: >900

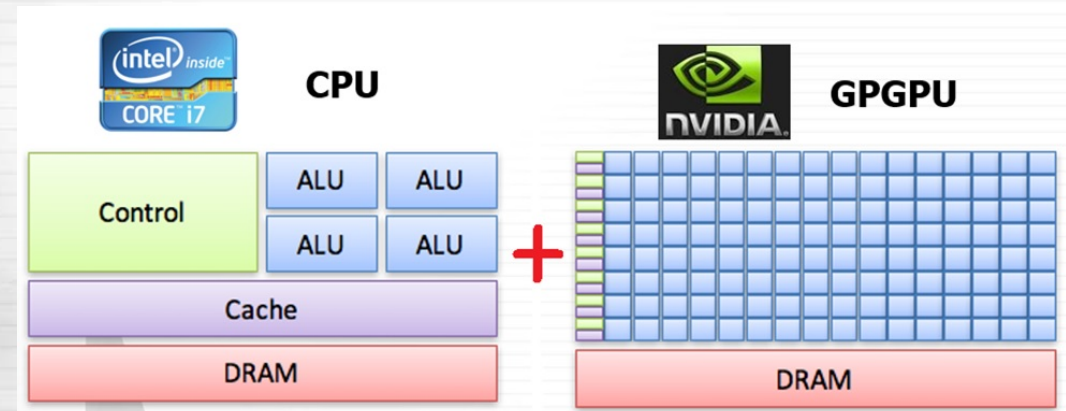
# NVIDIA Products Inference Process Diagram



# AI Systems

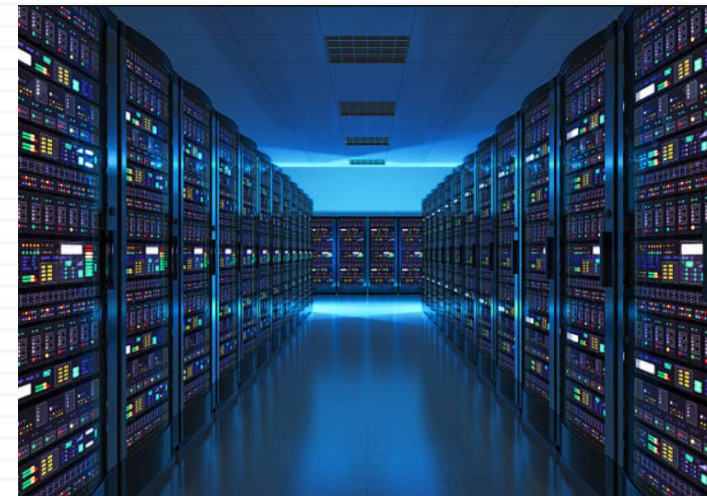


- ❖ Complete AI systems still require a regular processor to make a decision or to take an action based on the analyzed information
- ❖ GPGPU + CPU creates an AI-capable supercomputer



# Advantages of AI Systems

- ➊ AI systems can properly assess surrounding information, which allows reliable operation of autonomous systems
- ➋ AI can assess threats, issue warnings and eliminate false alarms in surveillance/security systems
- ➌ AI can significantly reduce data transfer and data storage requirements since it can store only data which requires attention/action



# Military and Aerospace Applications

- Autonomous Vehicles/Drones
- Video Recorders/Streaming
- Radar
- Flight Simulators
- Surveillance
- GPU Rendering (navigation, maps, etc.)
- Image Processing (CUDA accelerated)

- Intelligent Video Analytics



- Signal Processing



- Image capture and processing for aerospace and defense



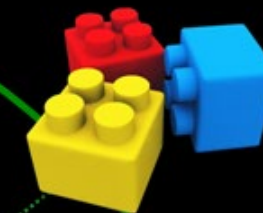
## NVIDIA Based Products



- UAS – Unmanned Aircraft Systems



- Autonomous Robotic Systems



- Persistent Video Surveillance

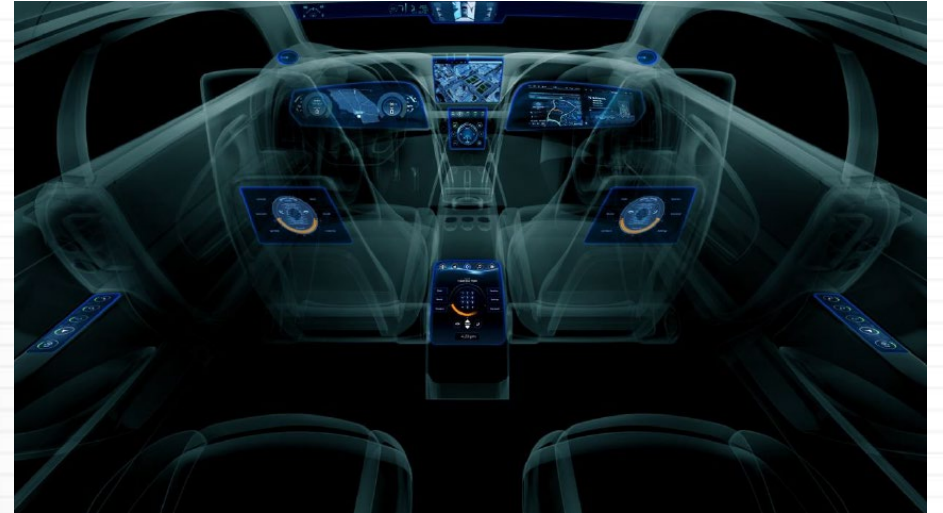


- UGV – Unmanned Ground Vehicle



# Industrial Applications

Smart Cities • Trains • Automotive • Drones • Security & Surveillance • Industrial Automation



# Available AI Solutions

“AI” in Aitech stands for  
“Artificial Intelligence”



GPGPU Fanless SFF  
RediBuilt Supercomputer



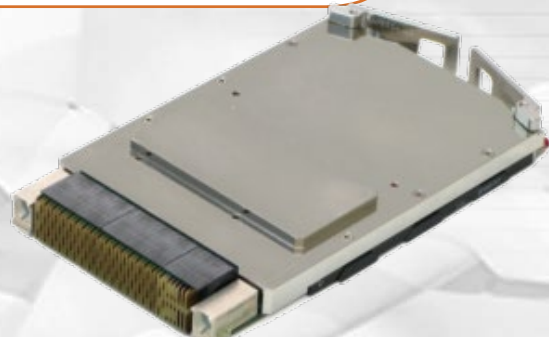
Industrial GPGPU  
Fanless RediBuilt SFF  
Supercomputer



RediBuilt GPGPU  
Rugged Computer



RediBuilt GPGPU  
Rugged Computer



3U VPX GPGPU Board



3U VPX GPGPU  
Supercomputer Board



Rugged RediBuilt  
HPEC and GPGPU



# *Thank You!*

