



DEEP  
LEARNING  
INSTITUTE

# DEEP LEARNING DEMYSTIFIED

---

Will Ramey

Director, Developer Programs  
NVIDIA Corporation

# DEFINITIONS

## ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



## MACHINE LEARNING

Machine learning begins to flourish.



## DEEP LEARNING

Deep learning breakthroughs drive AI boom.



1950's

1960's

1970's

1980's

1990's

2000's

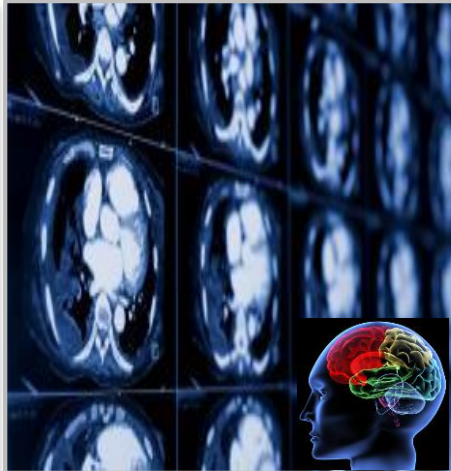
2010's

# DEEP LEARNING IS SWEEPING ACROSS INDUSTRIES

## Internet Services



## Medicine



## Media & Entertainment



## Security & Defense



## Autonomous Machines



- Image/Video classification
- Speech recognition
- Natural language processing

- Cancer cell detection
- Diabetic grading
- Drug discovery

- Video captioning
- Content based search
- Real time translation

- Face recognition
- Video surveillance
- Cyber security

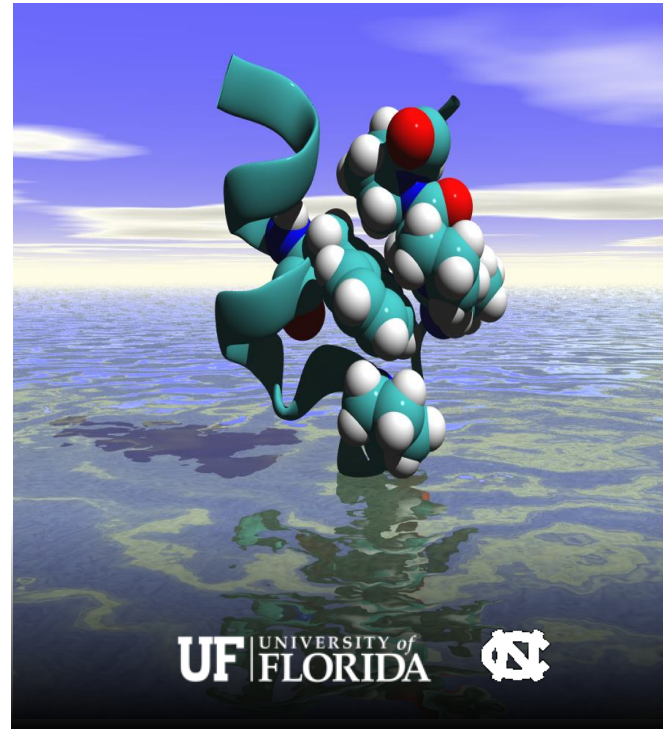
- Pedestrian detection
- Lane tracking
- Recognize traffic signs



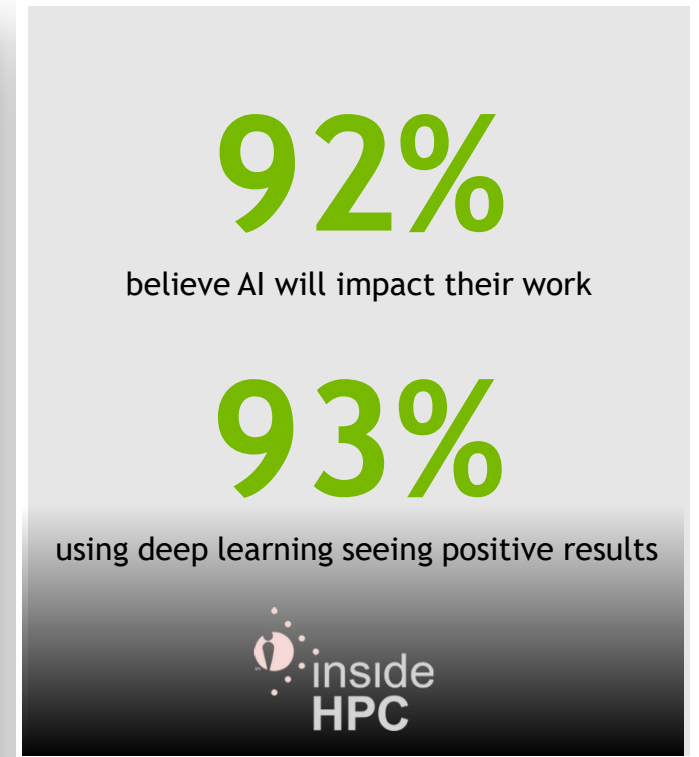
# DEEP LEARNING IS TRANSFORMING HPC



“Seeing” Gravity In Real Time



Accelerating Drug Discovery



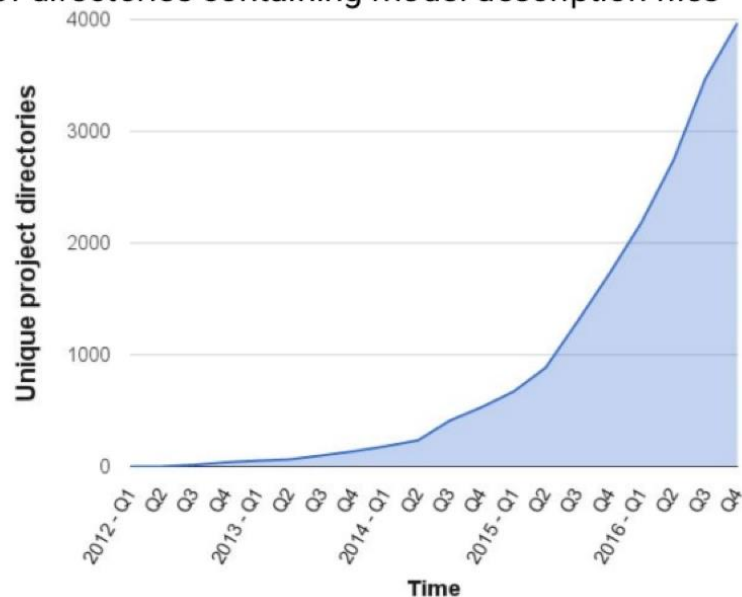
insideHPC.com Survey  
November 2016

# AI IS CRITICAL FOR INTERNET APPLICATIONS

Users Expect Intelligence In Services

## Growing Use of Deep Learning at Google

# of directories containing model description files



Across many products/areas:

- Android
- Apps
- drug discovery
- Gmail
- Image understanding
- Maps
- Natural language understanding
- Photos
- Robotics research
- Speech
- Translation
- YouTube
- ... many others ...



# THE EXPANDING UNIVERSE OF MODERN AI

## "THE BIG BANG"

Big Data  
GPU  
Algorithms

### RESEARCH



### CORE TECHNOLOGY / FRAMEWORKS



### AI-as-a-PLATFORM



### START-UPS



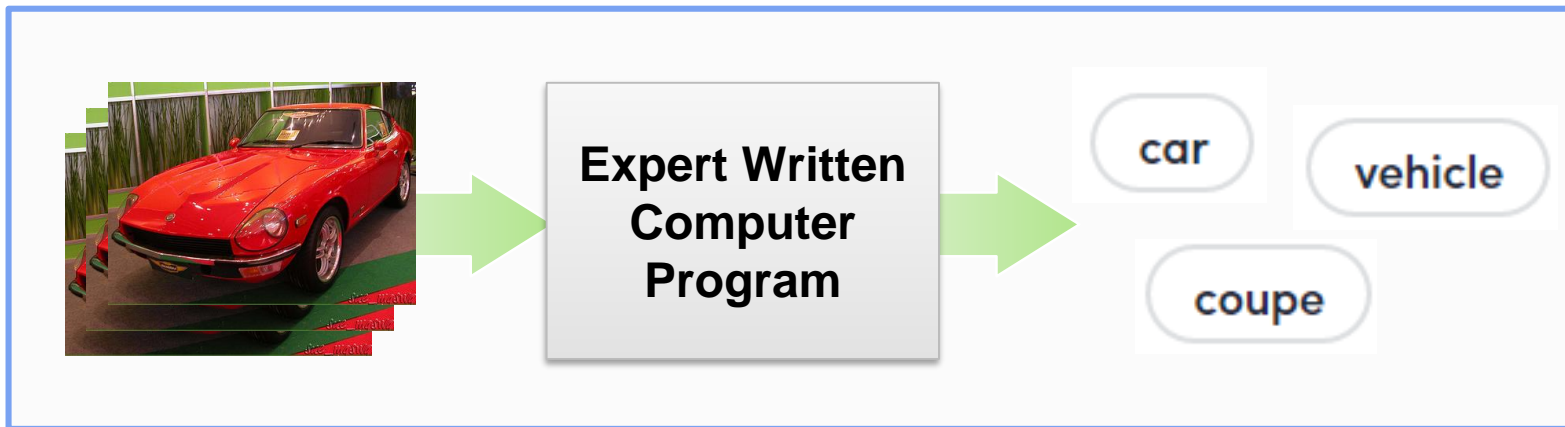
1,000+ AI START-UPS  
**\$5B IN FUNDING**  
 Source: Venture Scanner

### INDUSTRY LEADERS



# A NEW COMPUTING MODEL

## Algorithms that Learn from Examples

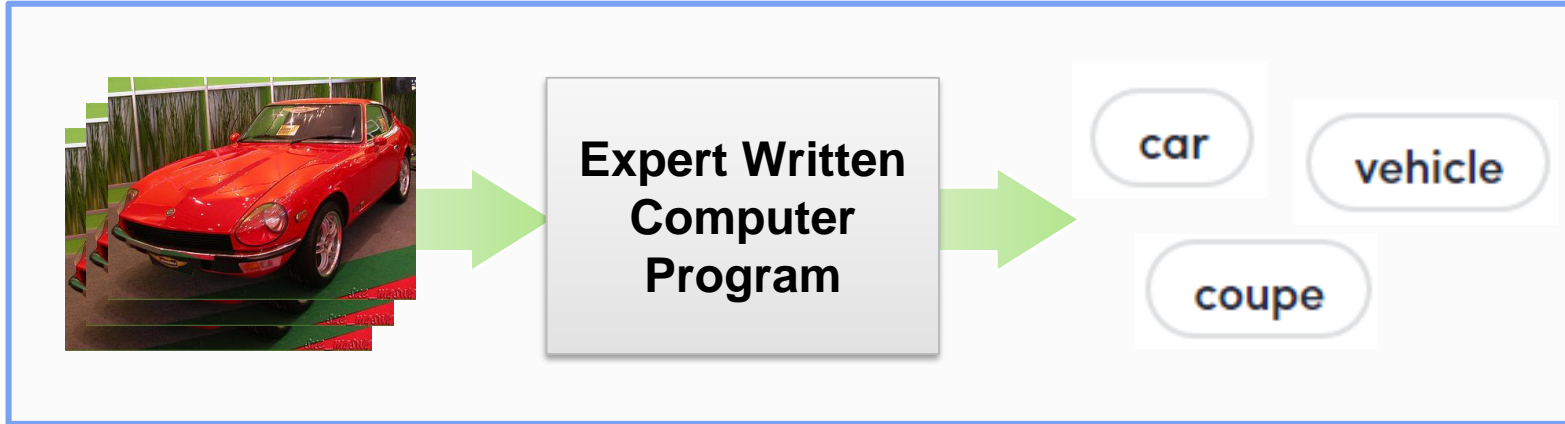


### Traditional Approach

- Requires domain experts
- Time consuming
- Error prone
- Not scalable to new problems

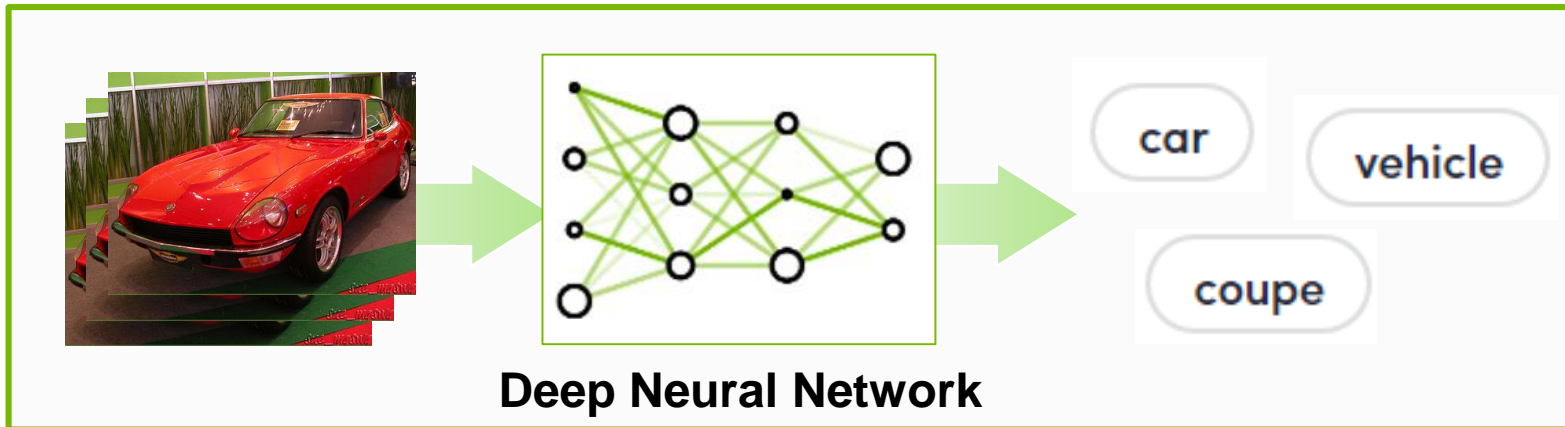
# A NEW COMPUTING MODEL

## Algorithms that Learn from Examples



### Traditional Approach

- Requires domain experts
- Time consuming
- Error prone
- Not scalable to new problems



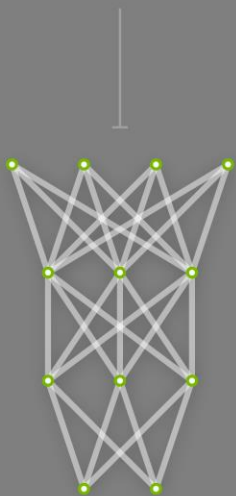
### Deep Learning Approach

- ✓ Learn from data
- ✓ Easily to extend
- ✓ Speedup with GPUs



# DEEP LEARNING

Untrained  
Neural Network  
Model

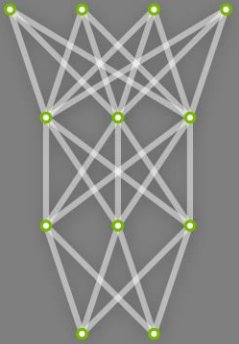


# DEEP LEARNING

## TRAINING

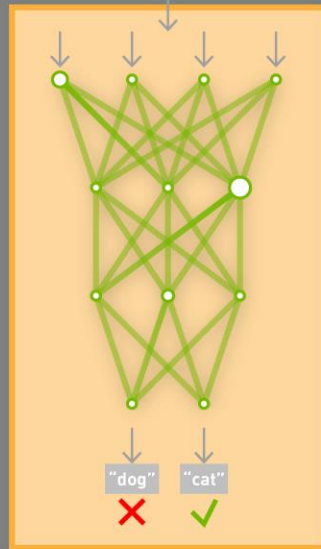
Learning a new capability  
from existing data

Untrained  
Neural Network  
Model



Deep Learning  
Framework

TRAINING  
DATASET

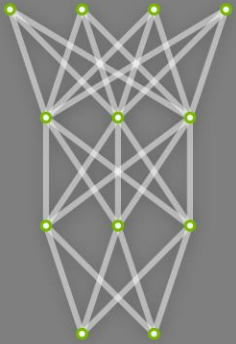


# DEEP LEARNING

## TRAINING

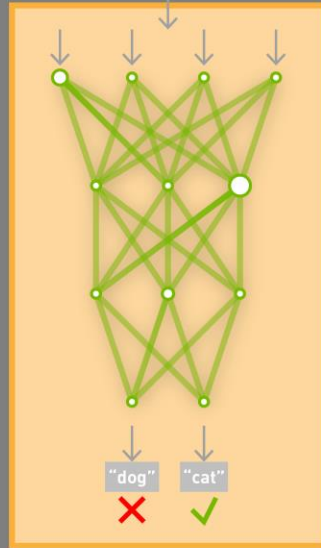
Learning a new capability  
from existing data

Untrained  
Neural Network  
Model



Deep Learning  
Framework

TRAINING  
DATASET



Trained Model  
New Capability

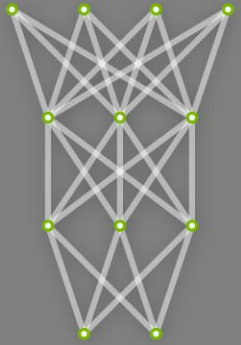


# DEEP LEARNING

## TRAINING

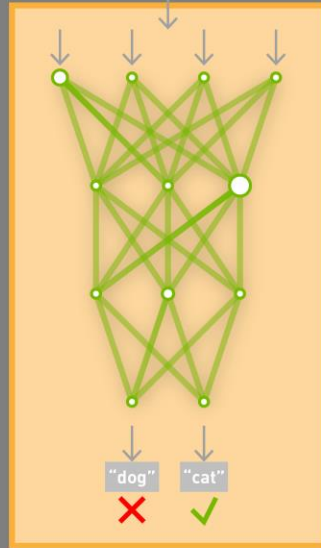
Learning a new capability  
from existing data

Untrained  
Neural Network  
Model



Deep Learning  
Framework

TRAINING  
DATASET



Trained Model  
New Capability



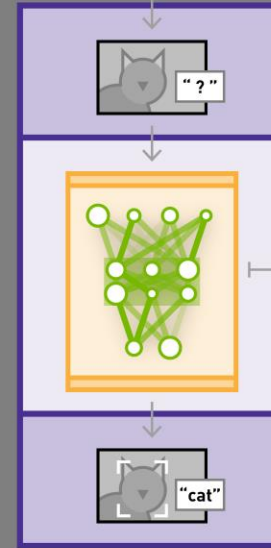
## INFERENCE

Applying this capability  
to new data

NEW  
DATA



App or Service  
Featuring Capability



Trained Model  
Optimized for  
Performance

# CHALLENGES

Deep Learning Needs	Why
Data Scientists	New computing model
Latest Algorithms	Rapidly evolving
Fast Training	Impossible -> Practical
Deployment Platforms	Must be available everywhere



# NVIDIA DEEP LEARNING INSTITUTE

Hands-on Training for Data Scientists and Software Engineers



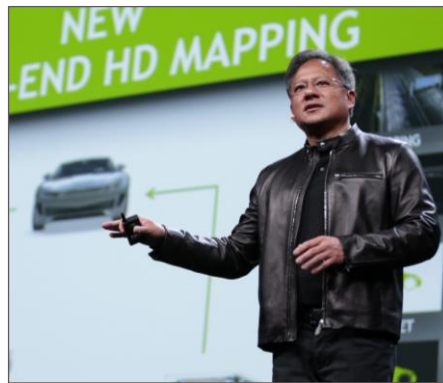
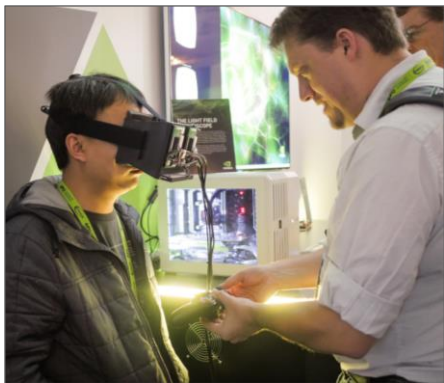
Helping the world to solve challenging problems using AI and deep learning

On-site workshops and online courses presented by certified instructors

Covering complete workflows for proven application use cases  
Self-Driving Cars, Healthcare, Intelligent Video Analytics, IoT/Robotics, Finance and more

[www.nvidia.com/dli](http://www.nvidia.com/dli)

# GPU TECHNOLOGY CONFERENCE



## ADVANCE YOUR DEEP LEARNING TRAINING AT GTC

Don't miss the world's most important event for GPU developers

---

Silicon Valley, May 8-11  
Beijing, September 26-27  
Munich, October 10-11

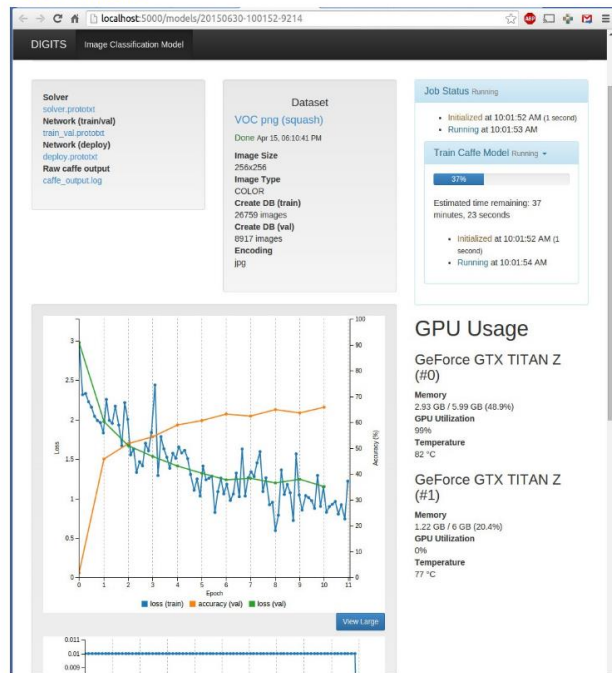
Israel, October 18  
Washington DC, November 1-2  
Tokyo, December 12-13

# DEEP LEARNING SOFTWARE

## NVIDIA DIGITS™

Interactively manage data and train deep learning models for image classification without the need to write code.

[Learn more](#)



## Deep Learning Frameworks

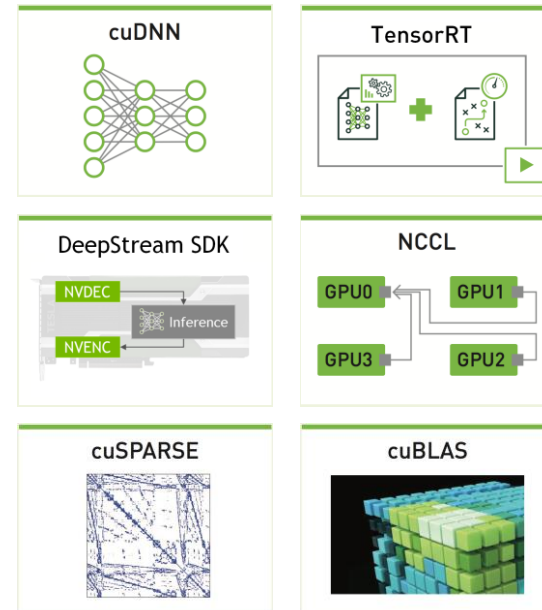
Design and train deep learning models using a high-level interface. Choose a deep learning framework that best suits your needs based on your choice of programming language, platform, and target application.

[Learn more](#)



## NVIDIA Deep Learning SDK

This SDK delivers high-performance multi-GPU acceleration and industry-vetted deep learning algorithms, and is designed for easy drop-in acceleration for deep learning frameworks.



# END-TO-END PRODUCT FAMILY

TRAINING

INFERENCE

FULLY INTERGRATED DL SUPERCOMPUTER



DGX-1

DESKTOP



Titan X Pascal

DATA CENTER



Tesla P100

DATA CENTER

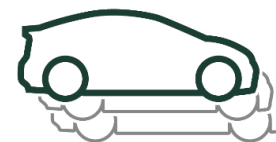


Tesla P100



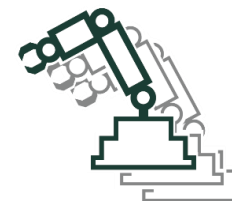
Tesla P4

AUTOMOTIVE



Drive PX

EMBEDDED



Jetson TX

# CHALLENGES

Deep Learning Needs	Why
Data Scientists	New computing model
Latest Algorithms	Rapidly evolving
Fast Training	Impossible -> Practical
Deployment Platforms	Must be available everywhere



# CHALLENGES

Deep Learning Needs	NVIDIA Delivers
Data Scientists	Deep Learning Institute, GTC, DIGITS
Latest Algorithms	DL SDK, GPU-Accelerated Frameworks
Fast Training	DGX, P100, TITAN X
Deployment Platforms	TensorRT, P100, P4, Drive PX, Jetson





# READY TO GET STARTED?

## Project Checklist

1. What problem are you solving, what are the DL tasks?
2. On what platform(s) will you train and deploy?
3. What data do you have/need, and how is it labeled?
4. Which deep learning framework & tools will you use?

# WHAT PROBLEM ARE SOLVING?

## Defining the AI/DL Tasks

INPUTS	QUESTION	AI/DL TASK	EXAMPLE OUTPUTS
 Text Data  Images   Video  Audio	Is “it” <u>present</u> or not?	Detection	Cancer Detection
	What <u>type</u> of thing is “it”?	Classification	Tumor Identification
	To what <u>extent</u> is “it” present?	Segmentation	Tumor Size/Shape Analysis
	What is the likely <u>outcome</u> ?	Prediction	Survivability Prediction
	What will likely <u>satisfy the objective</u> ?	Recommendation	Therapy Recommendation

# SELECTING A DEEP LEARNING FRAMEWORK

## Considerations

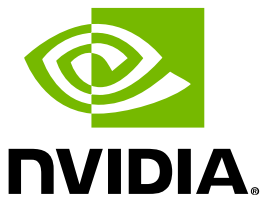
1. Type of problem
2. Training & deployment platforms
3. DNN models available, layer types supported
4. Latest algos & GPU acceleration: cuDNN, NCCL, etc.
5. Usage model/interfaces: GUI, command line, programming language, etc.
6. Easy to install and get started: containers, docs, code samples, tutorials, ...
7. Enterprise integration, vendors, ecosystem

# START SIMPLE, LEARN FAST



How One NVIDIAIAN Uses Deep Learning to  
Keep Cats from Pooping on His Lawn





DEEP  
LEARNING  
INSTITUTE

[www.nvidia.com/dli](http://www.nvidia.com/dli)