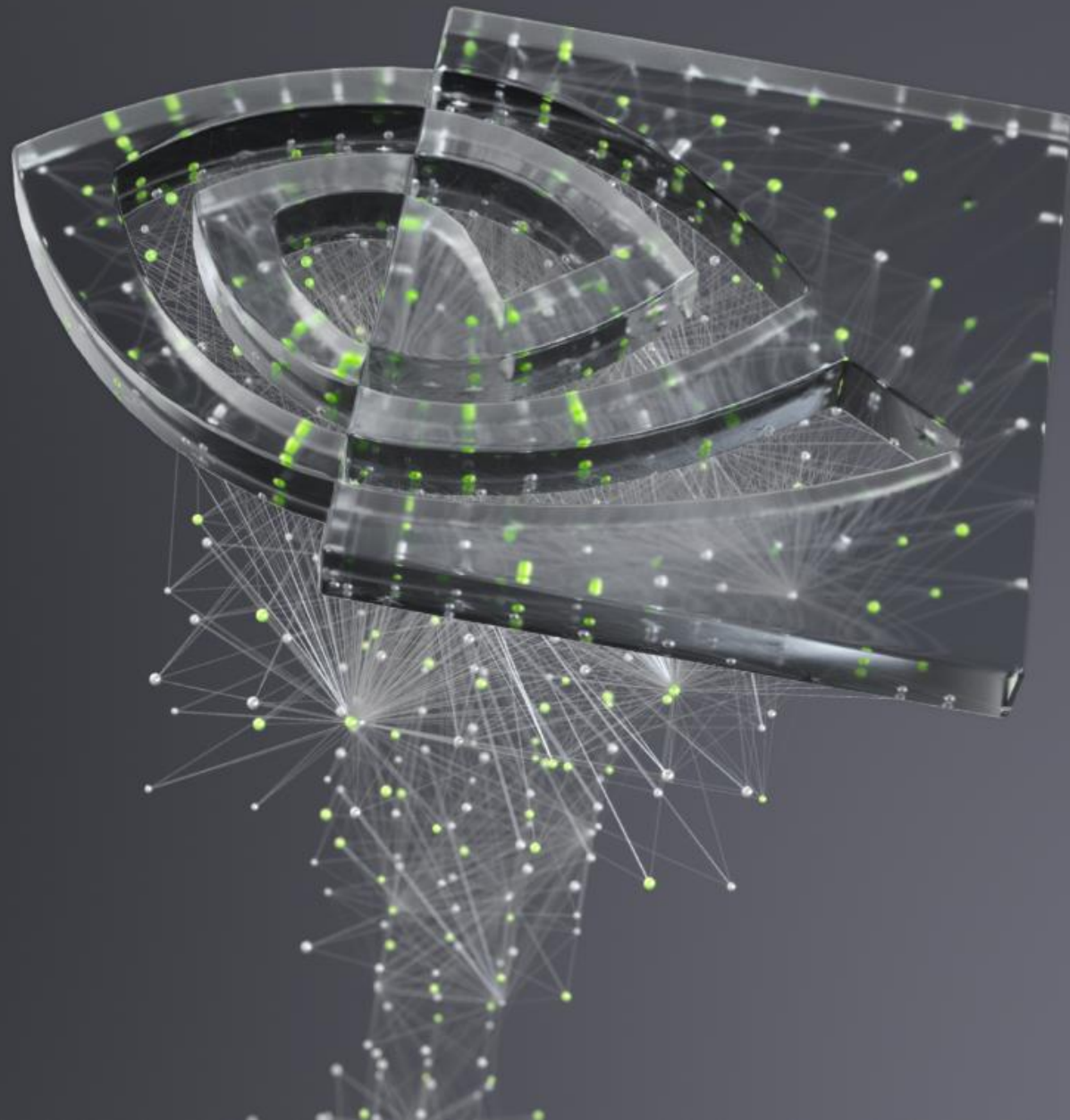# NVIDIA DEEP LEARNING INSTITUTE

FUNDAMENTALS OF DEEP LEARNING

Part 6: Advanced Architectures

AGENDA

Part 1: An Introduction to Deep Learning

Part 2: How a Neural Network Trains

Part 3: Convolutional Neural Networks

Part 4: Data Augmentation and Deployment

Part 5: Pre-trained Models

Part 6: Advanced Architectures

AGENDA – PART 6

- Moving Forward

- Natural Language Processing

- Recurrent Neural Networks

- Other Architectures

- Closing Thoughts
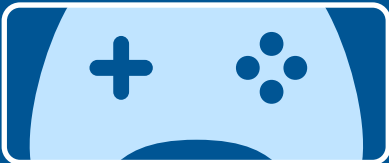
MOVING FORWARD

FIELDS OF AI

Computer Vision
- Optometry

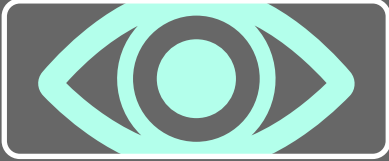**Natural Language Processing**
- Linguistics

Reinforcement Learning
- Game Theory
- Psychology

Anomaly Detection
- Security
- Medicine

FIELDS OF AI

Computer Vision
- Optometry

Natural Language Processing
- Linguistics

Reinforcement Learning
- Game Theory
- Psychology

Anomaly Detection
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FIELDS OF AI

Computer Vision
- Optometry

Natural Language Processing
- Linguistics

Reinforcement Learning
- Game Theory
- Psychology

Anomaly Detection
- Security
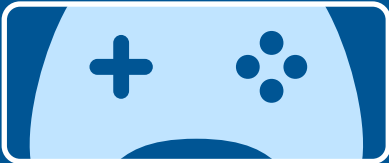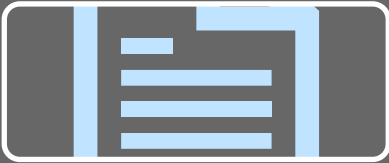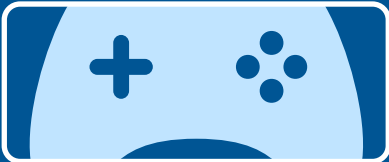- Medicine

NATURAL LANGUAGE PROCESSING

FROM WORDS TO NUMBERS

"A dog barked at a cat."

[1, 10, 7, 4, 1, 8]

DICTIONARY

1. A
2. AN
3. AND
4. AT
5. ATE
6. BARK
7. BARKED
8. CAT
9. CATS
10. DOG
11. DOGS
12. EAT

FROM WORDS TO NUMBERS

Inputs

A
An
And
At
Ate
Bark
Barked
Cat
Cats
Dog
Dogs
Eat

Outputs

A
An
And
At
Ate
Bark
Barked
Cat
Cats
Dog
Dogs
Eat

DICTIONARY

1. A
2. AN
3. AND
4. AT
5. ATE
6. BARK
7. BARKED
8. CAT
9. CATS
10. DOG
11. DOGS
12. EAT

FROM WORDS TO NUMBERS

FROM WORDS TO NUMBERS

Big

Giraffe
(.9, .9)

Llama
(-.9, .1)

Domestic ←———————————→ Wild

Falcon
(.15, -.4)

Puffin
(.85, -.65)

Kitty
(-.75, -.8)

Small
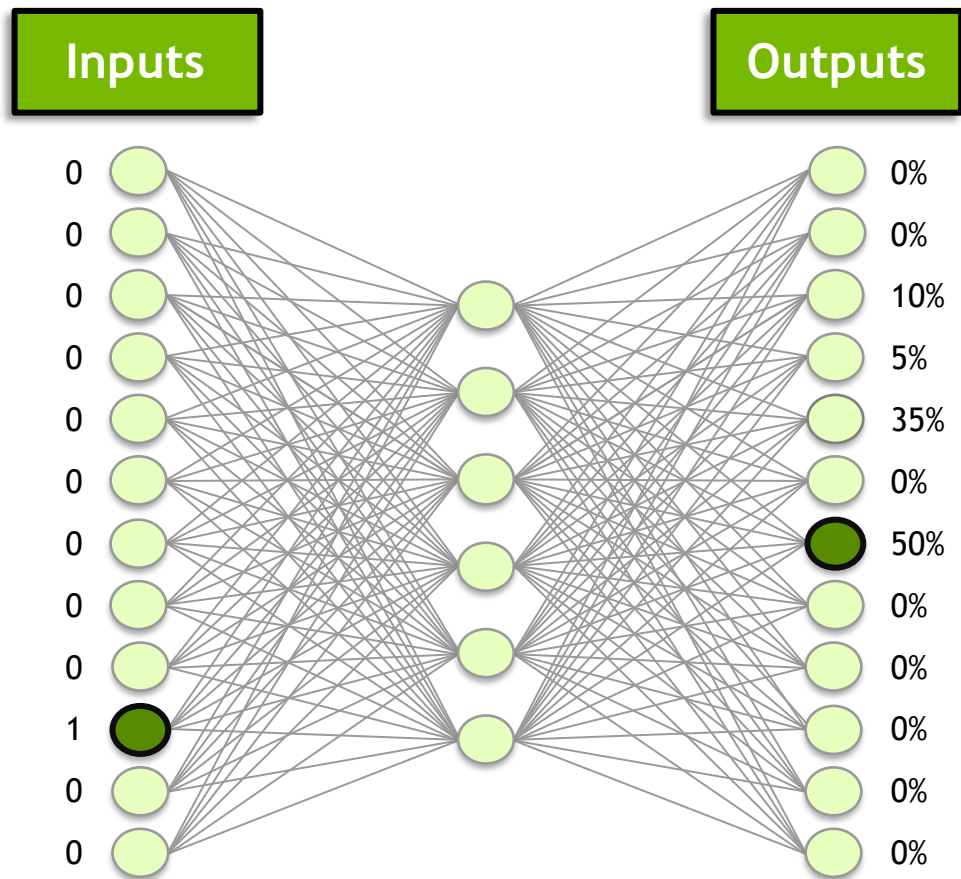
BIGGER DICTIONARY

#	Word	#	Word	#	Word
1.	A	31.	ATE	61.	CATS
2.	AN	32.	BARK	62.	DOG
3.	AND	33.	BARKED	63.	DOGS
4.	AT	34.	CAT	64.	EAT
5.	ATE	35.	CATS	65.	EATEN
6.	BARK	36.	DOG	66.	A
7.	BARKED	37.	DOGS	67.	AN
8.	CAT	38.	EAT	68.	AND
9.	CATS	39.	EATEN	69.	AT
10.	DOG	40.	A	70.	ATE
11.	DOGS	41.	AN	71.	BARK
12.	EAT	42.	AND	72.	BARKED
13.	EATEN	43.	AT	73.	CAT
14.	A	44.	ATE	74.	CATS
15.	AN	45.	BARK	75.	DOG
16.	AND	46.	BARKED	76.	DOGS
17.	AT	47.	CAT	77.	EAT
18.	ATE	48.	CATS	78.	EATEN
19.	BARK	49.	DOG	79.	...
20.	BARKED	50.	DOGS	80.	...
21.	CAT	51.	EAT	81.	...
22.	CATS	52.	EATEN	82.	...
23.	DOG	53.	A		
24.	DOGS	54.	AN		
25.	EAT	55.	AND		
26.	EATEN	56.	AT		
27.	A	57.	ATE		
28.	AN	58.	BARK		
29.	AND	59.	BARKED		
30.	AT	60.	CAT		

FROM WORDS TO NUMBERS
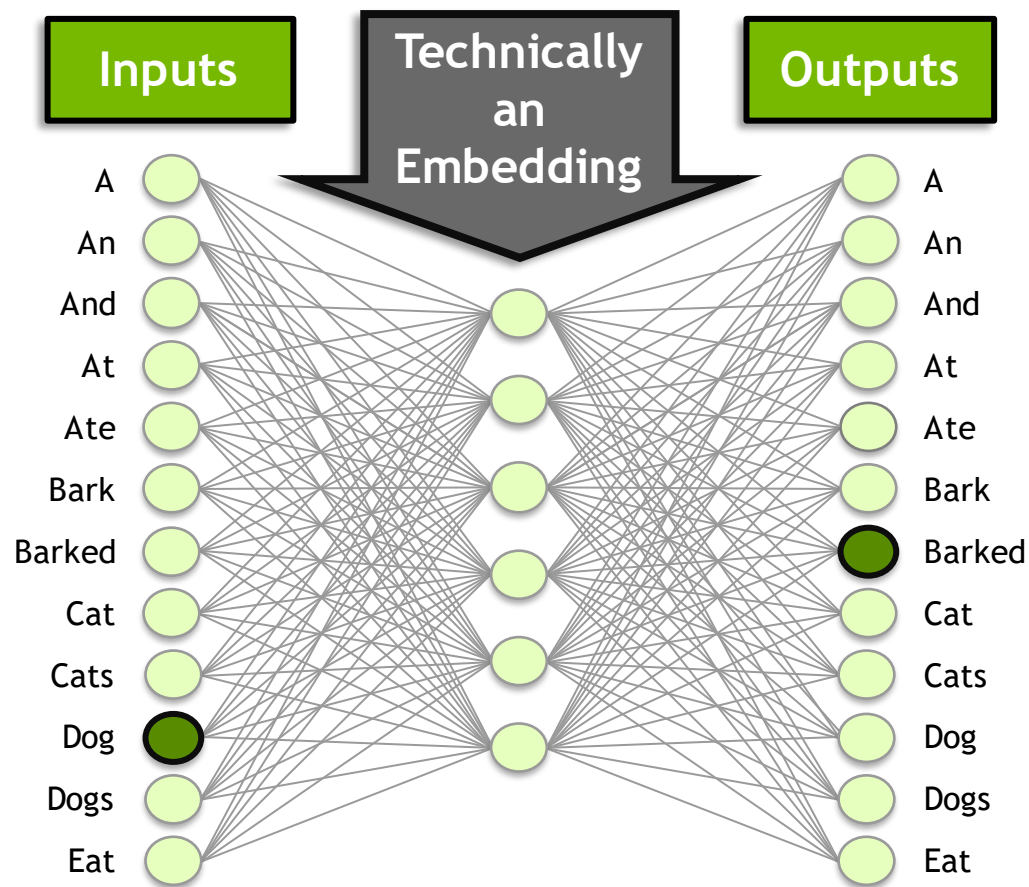
Inputs

Technically an Embedding

Outputs

Inputs: A, An, And, At, Ate, Bark, Barked, Cat, Cats, Dog, Dogs, Eat

Outputs: A, An, And, At, Ate, Bark, Barked, Cat, Cats, Dog, Dogs, Eat

DICTIONARY

1. A
2. AN
3. AND
4. AT
5. ATE
6. BARK
7. BARKED
8. CAT
9. CATS
10. DOG
11. DOGS
12. EAT

NVIDIA DEEP LEARNING INSTITUTE

RECURRENT NEURAL NETWORKS
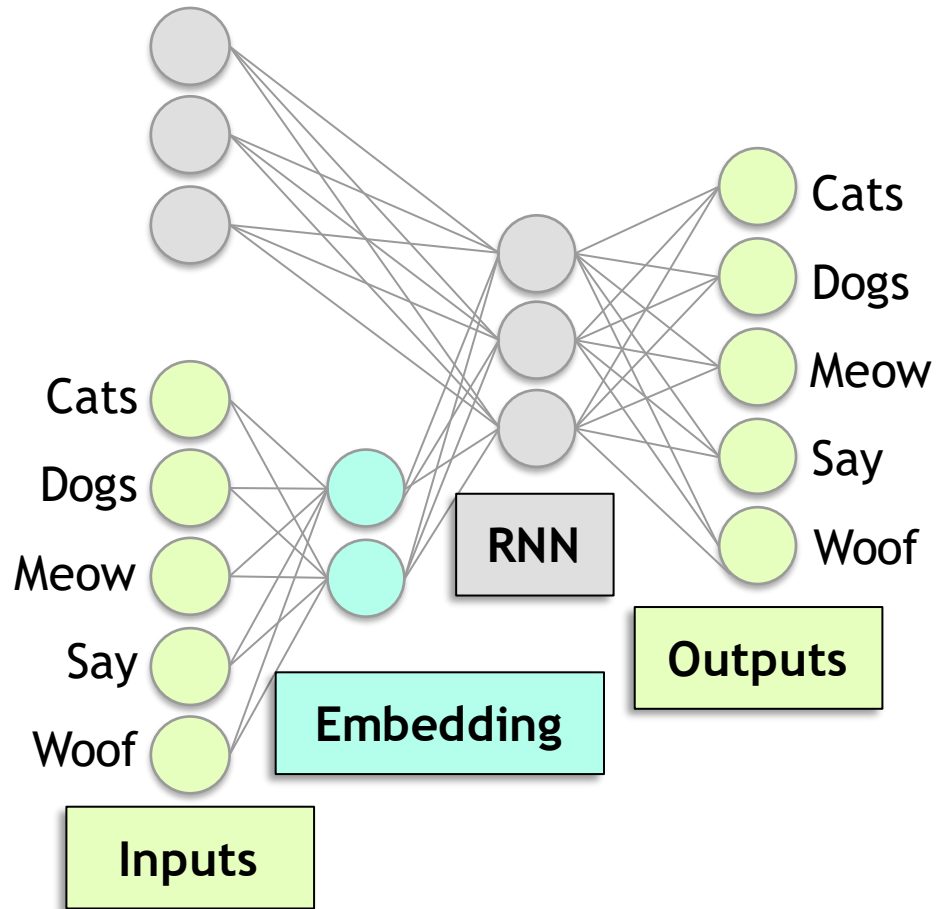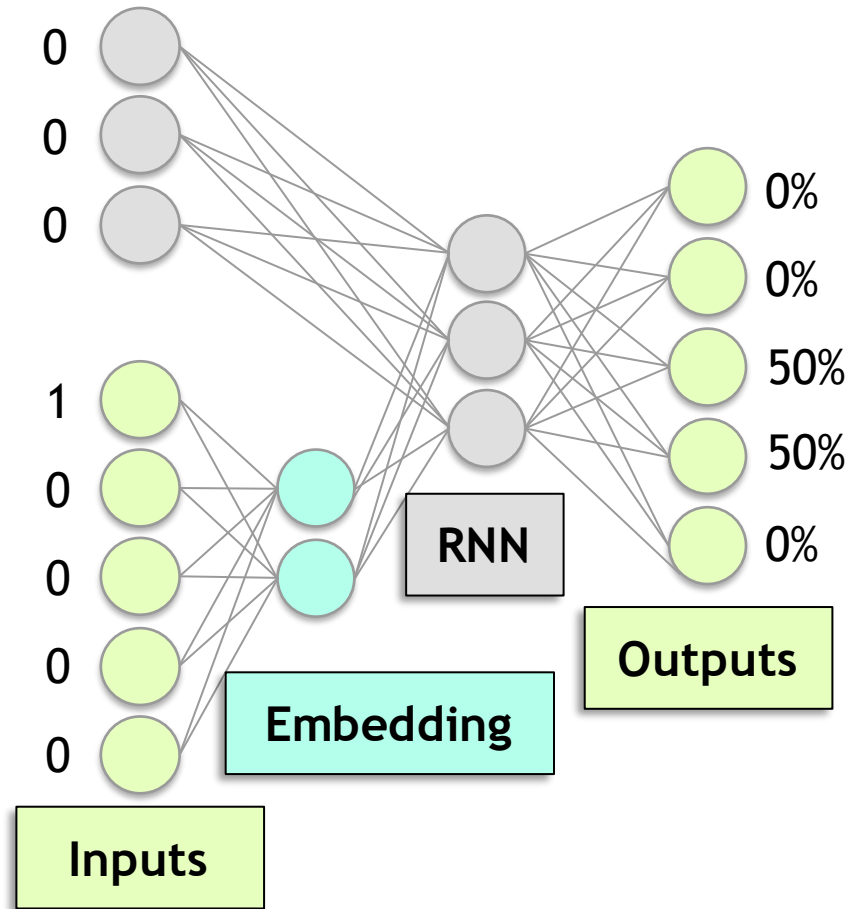
RECURRENT NEURAL NETWORKS

"Cats say ___."

"Dogs say ___."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

RECURRENT NEURAL NETWORKS

"Cats say ____."

"Dogs say ____."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

Inputs: Cats, Dogs, Meow, Say, Woof

Embedding

RNN

Outputs: Cats, Dogs, Meow, Say, Woof

RECURRENT NEURAL NETWORKS

0
0
0

1
0
0
0
0

Inputs

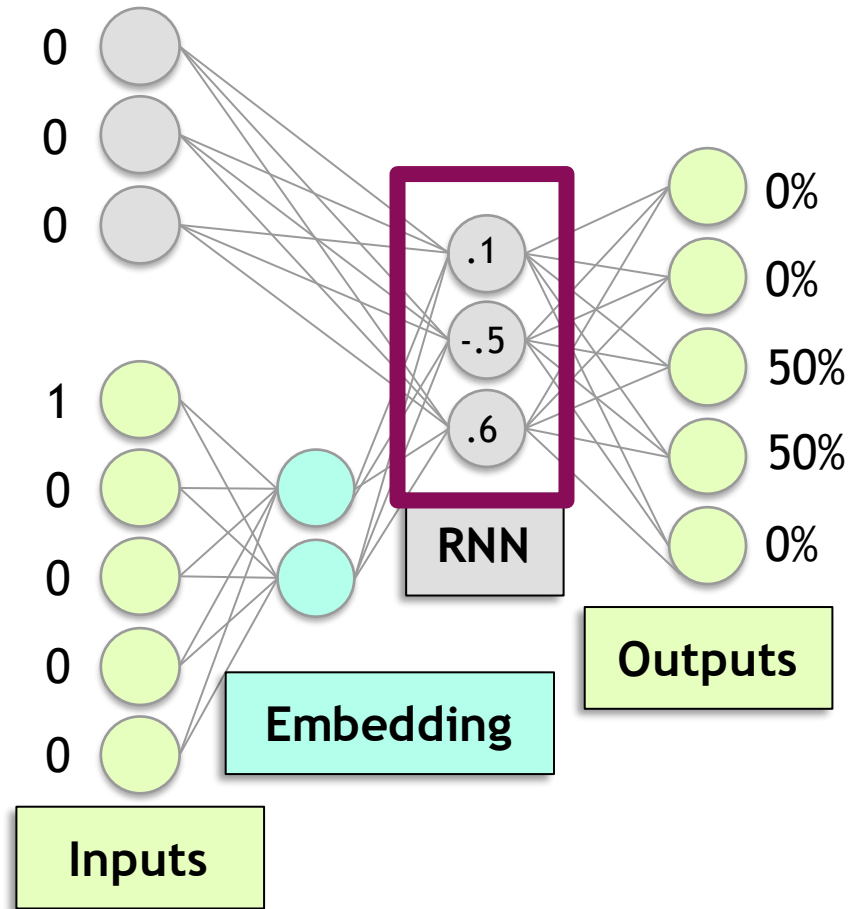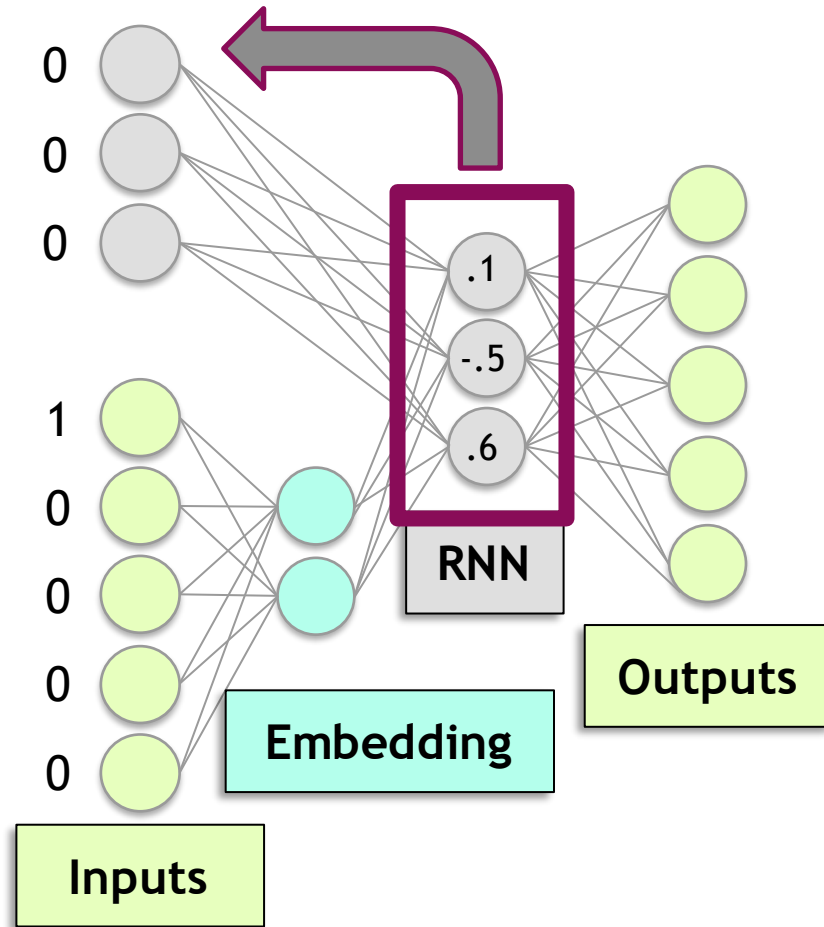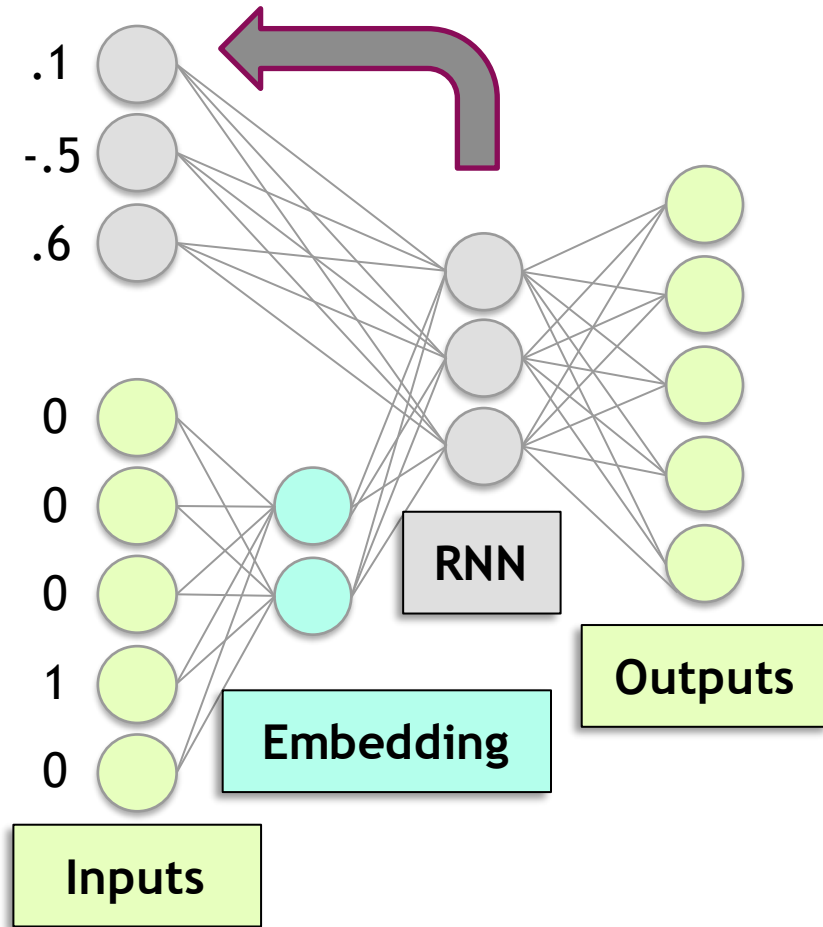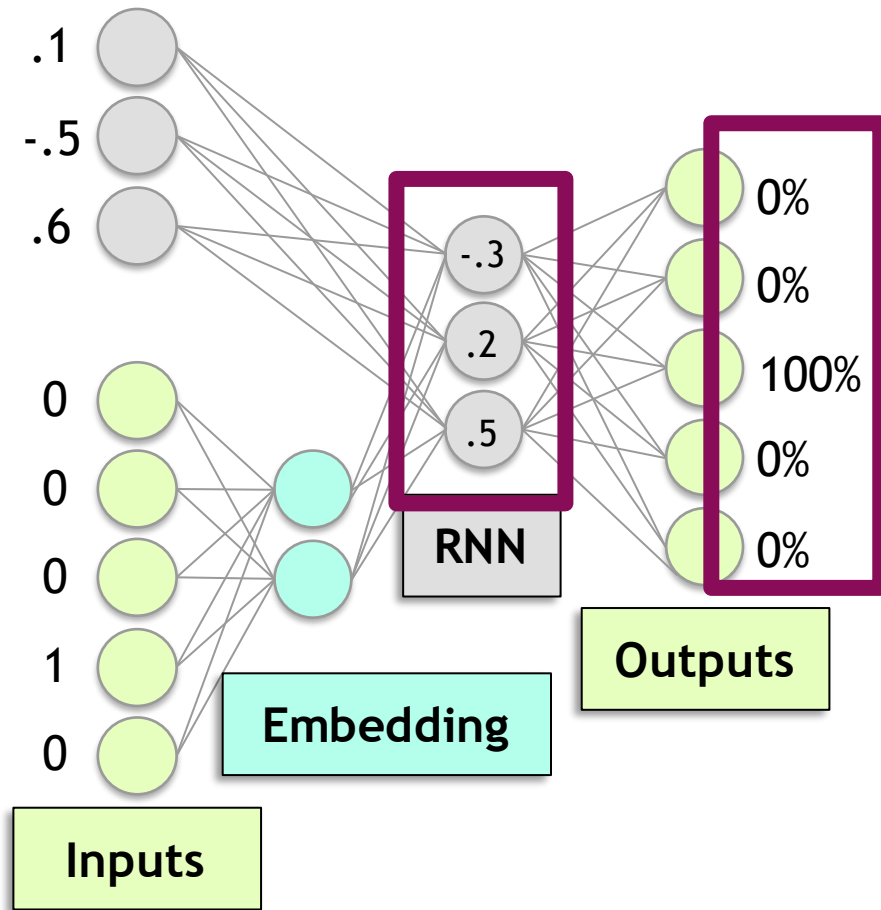**Embedding**

RNN

0%
0%
50%
50%
0%

Outputs

"Cats say ____."

"Dogs say ____."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

RECURRENT NEURAL NETWORKS

"Cats say ____."

"Dogs say ____."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

Inputs:
0
0
0
1
0
0
0
0

Embedding

RNN: .1, -.5, .6

Outputs:
0%
0%
50%
50%
0%

RECURRENT NEURAL NETWORKS

0
0
0

1
0
0
0
0

Inputs

Embedding

.1
-.5
.6

RNN

Outputs

"Cats say ___."

"Dogs say ___."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

RECURRENT NEURAL NETWORKS

.1
-.5
.6
0
0
0
1
0

Inputs

Embedding

RNN

Outputs

"Cats say ____."

"Dogs say ____."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

RECURRENT NEURAL NETWORKS

.1
-.5
.6

-.3
.2
.5

RNN

0%
0%
100%
0%
0%

Outputs

0
0
0
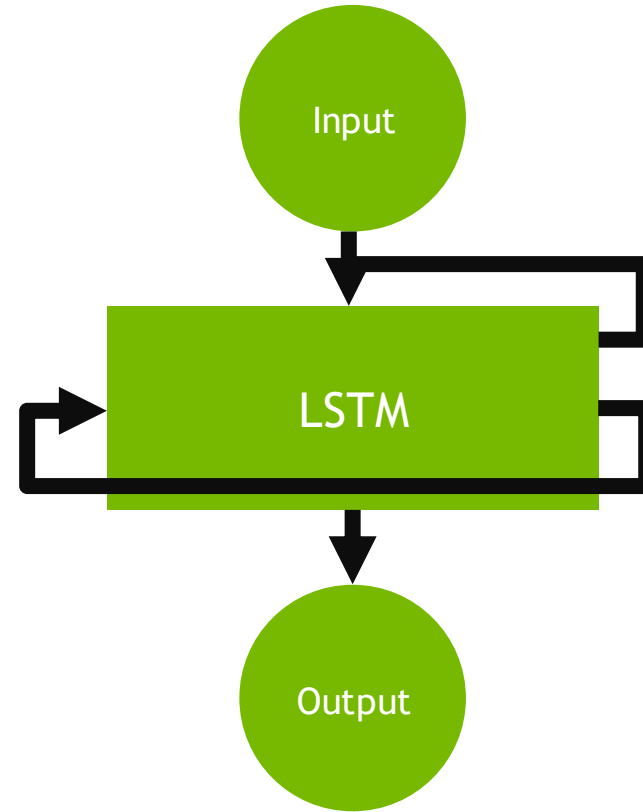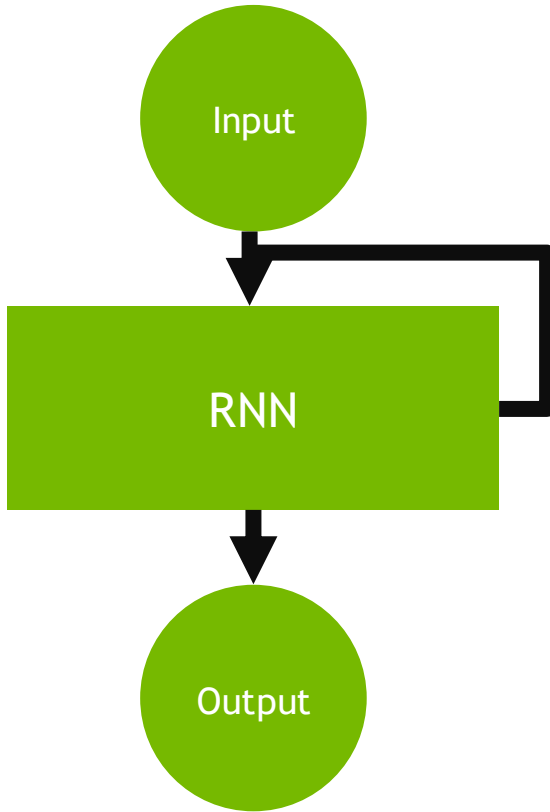1
0

Embedding

Inputs

"Cats say ___."

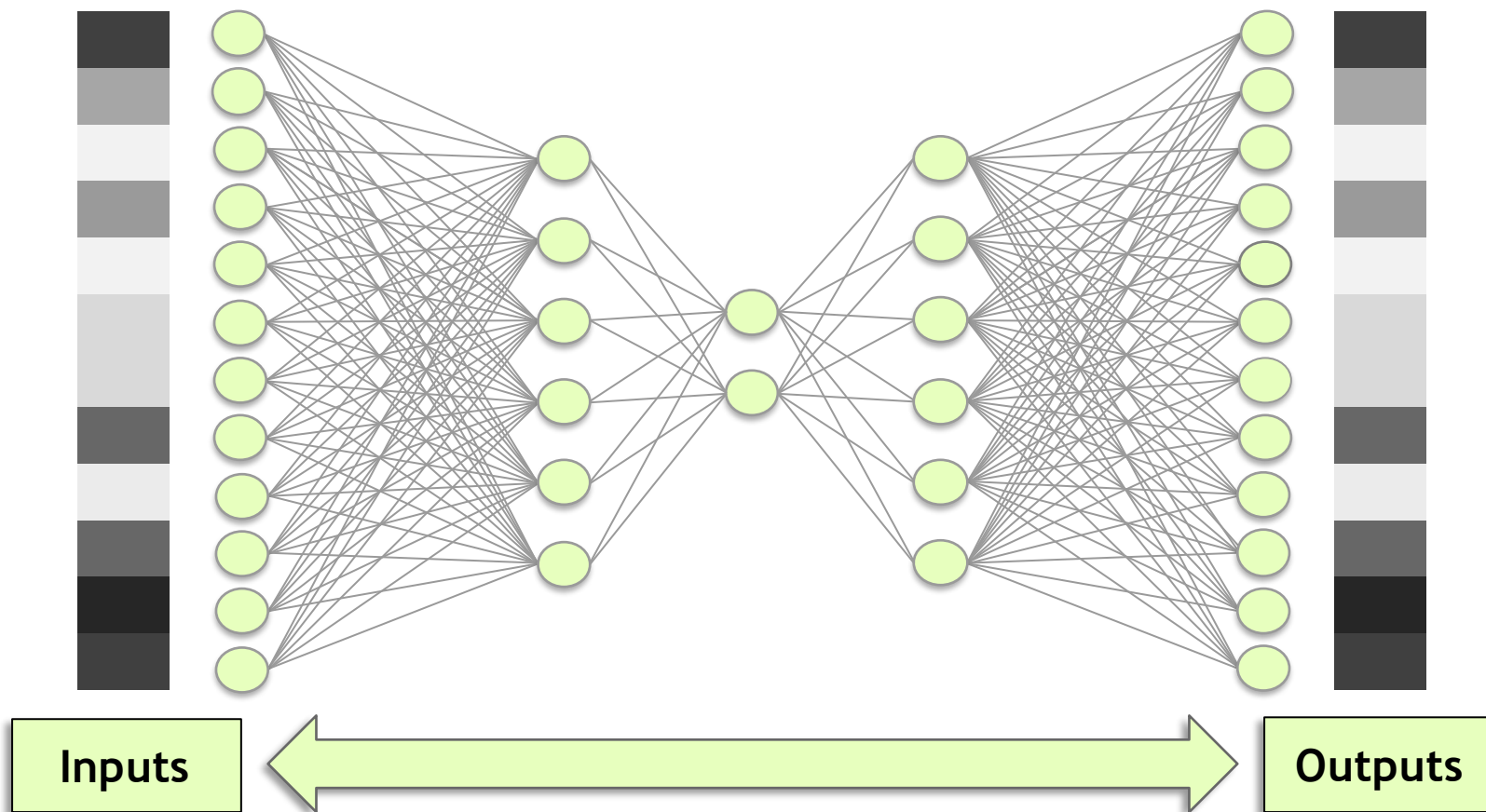"Dogs say ___."

DICTIONARY

1. CATS
2. DOGS
3. MEOW
4. SAY
5. WOOF

RECURRENT NEURAL NETWORKS

OTHER ARCHITECTURES

AUTOENCODERS
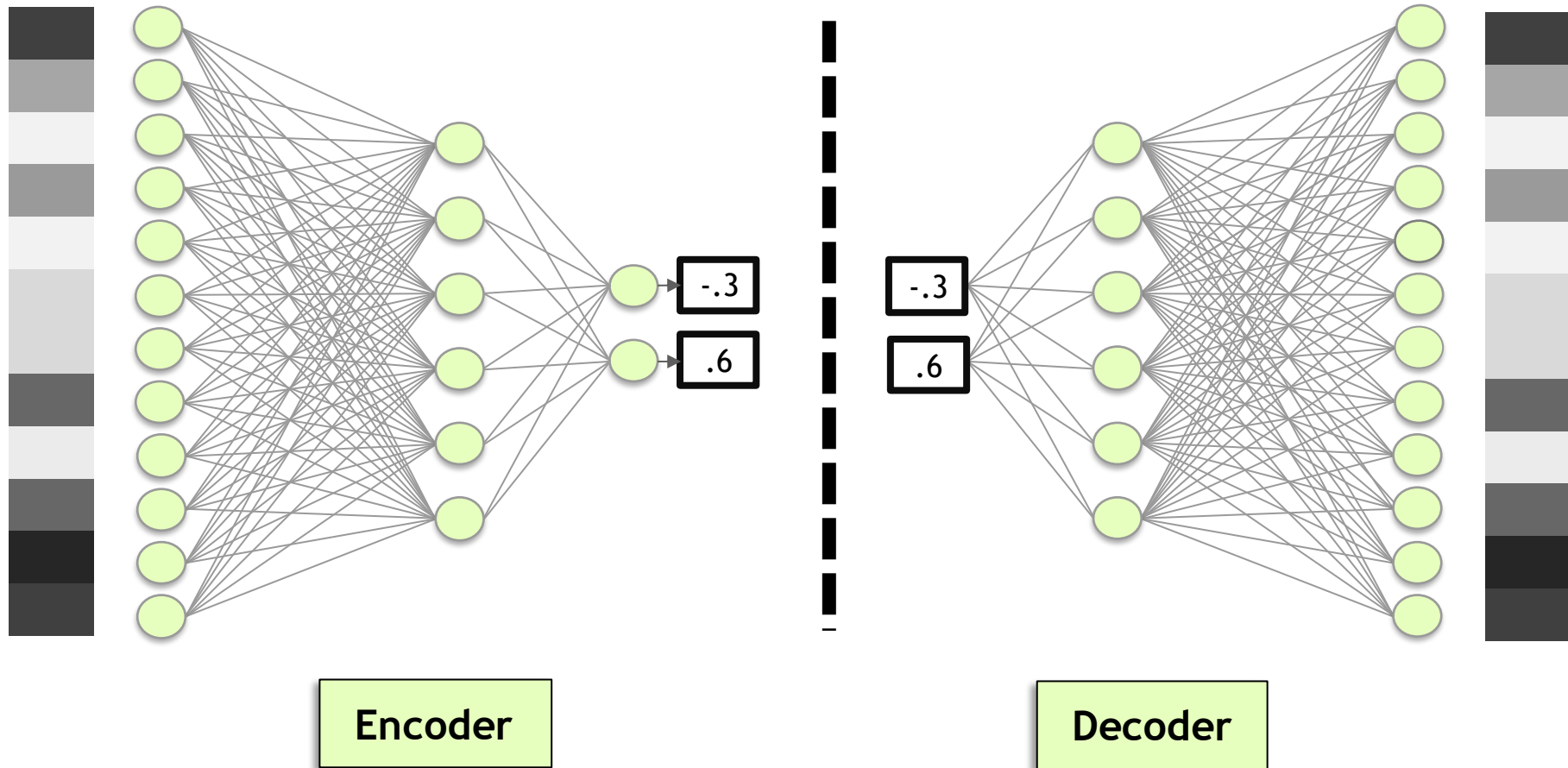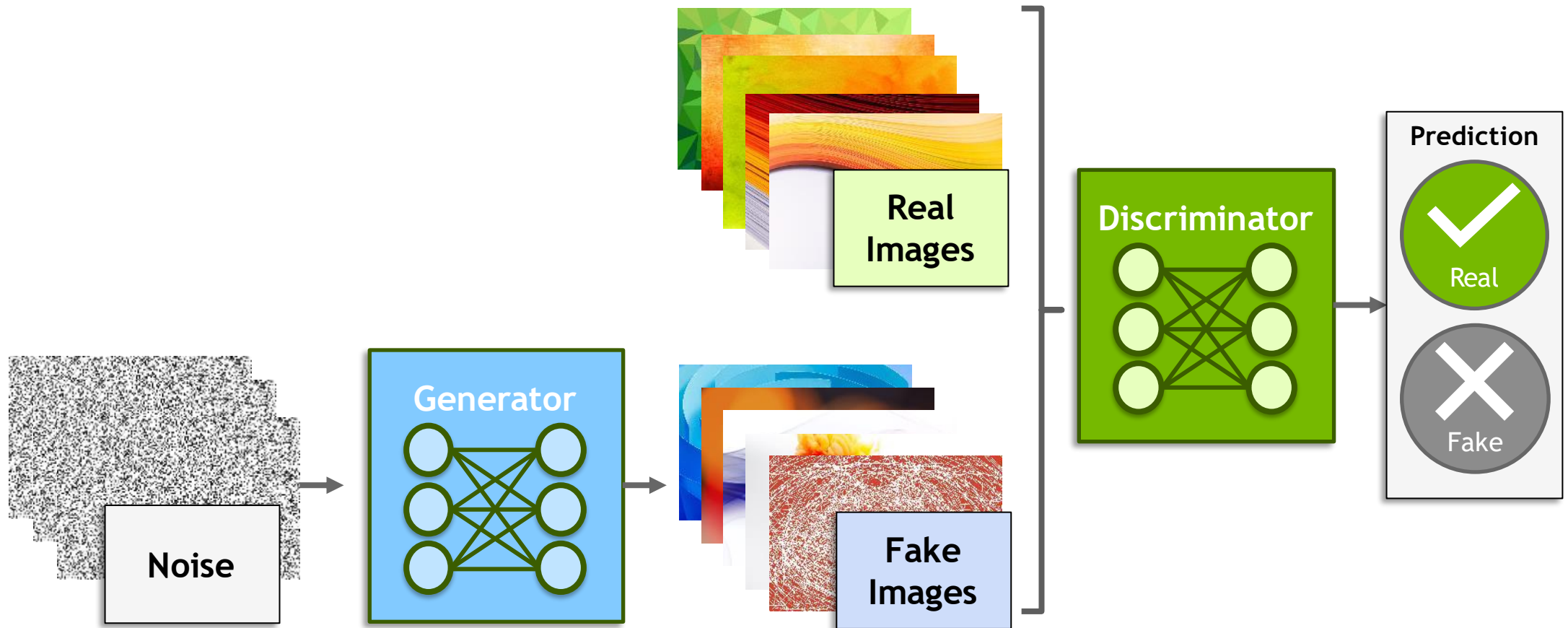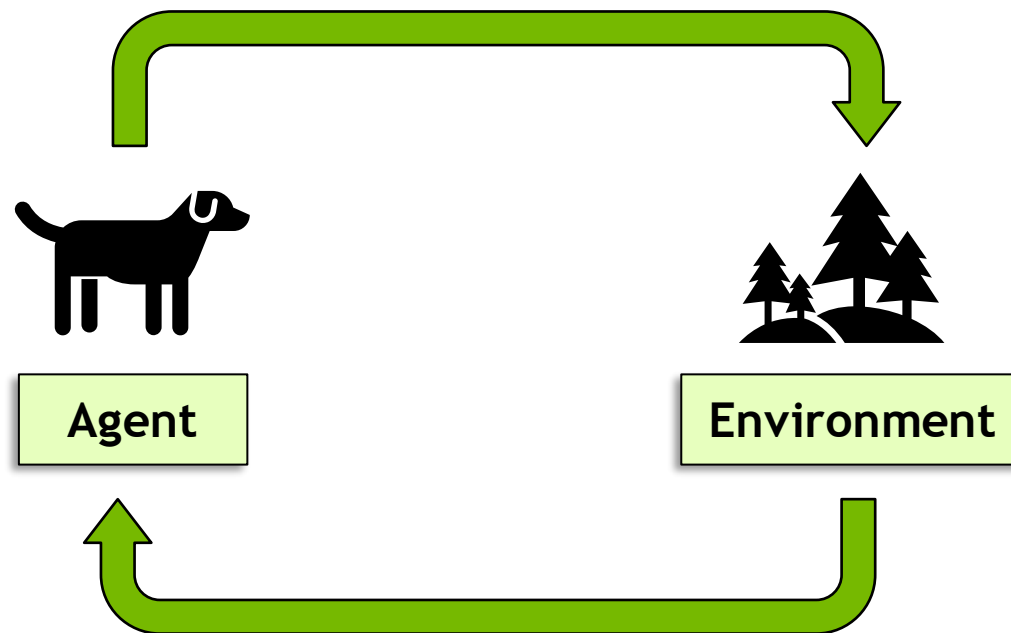

Inputs ⟷ Outputs

AUTOENCODERS

Inputs ⟵⟶ Outputs

AUTOENCODERS

-.3

.6

-.3

.6

Encoder

Decoder
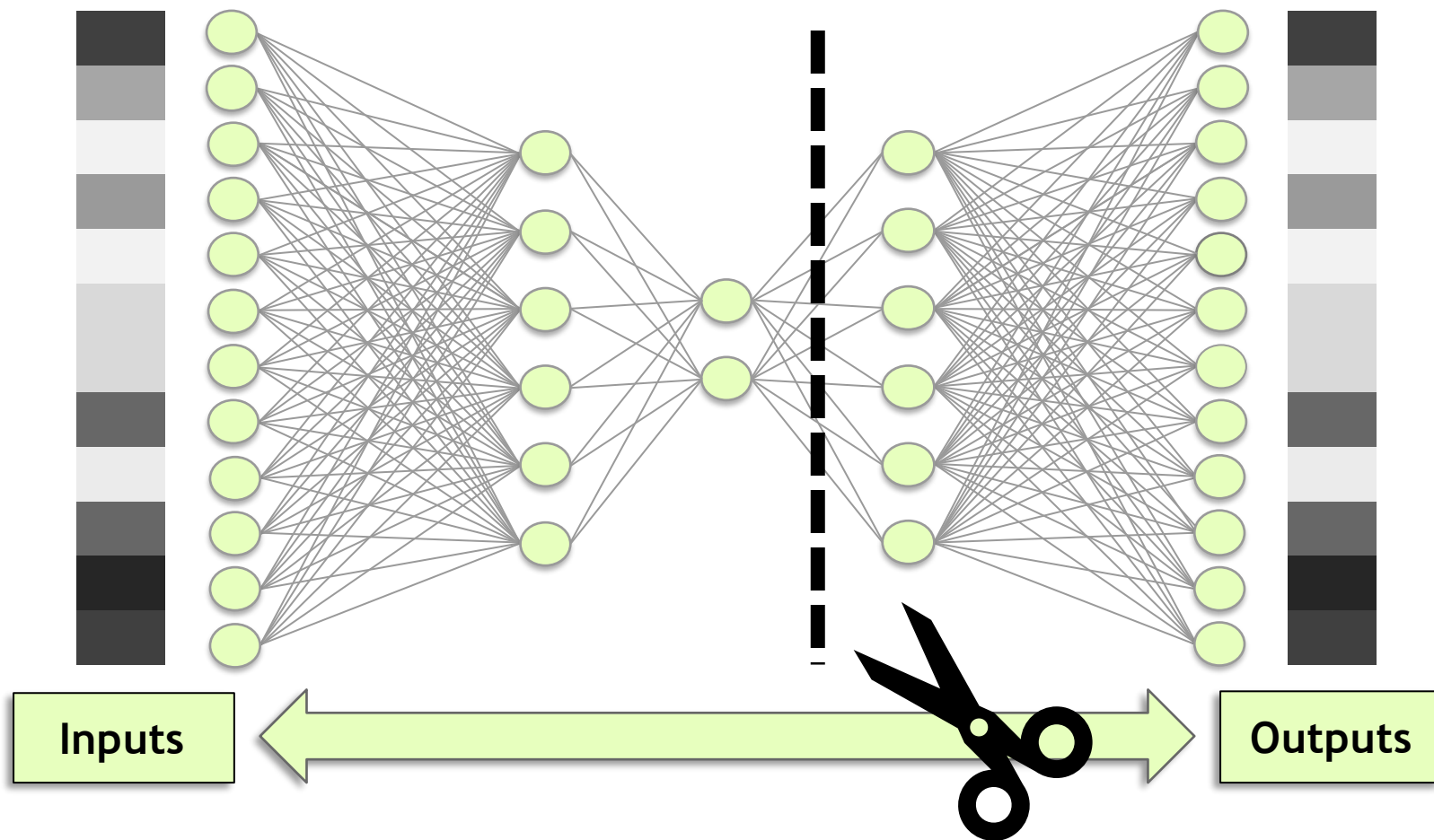
GENERATIVE ADVERSARIAL NETWORKS (GANS)

REINFORCEMENT LEARNING

Agent

Environment

NEXT STEPS

ENABLING PORTABILITY WITH NGC CONTAINERS

Extensive
- Diverse range of workloads and industry specific use cases

Optimized
- DL containers updated monthly
- Packed with latest features and superior performance

Secure & Reliable
- Scanned for vulnerabilities and crypto
- Tested on workstations, servers, & cloud instances

Scalable
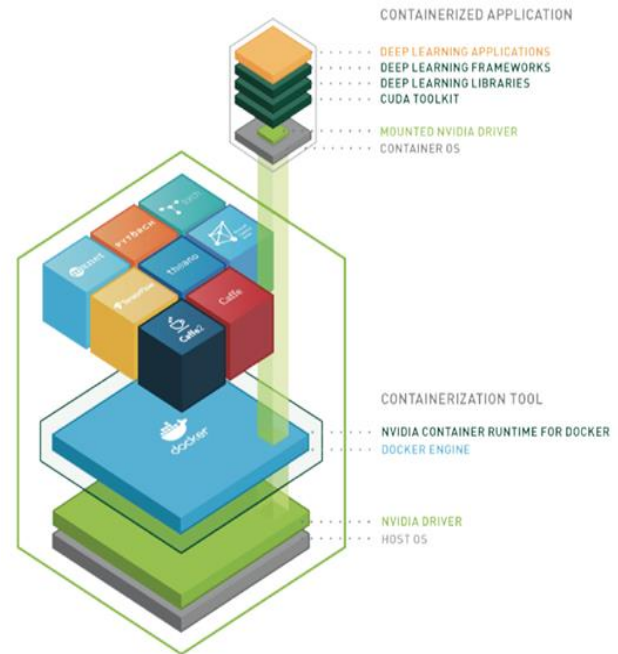- Supports multi-GPU & multi-node systems

Designed for Enterprise & HPC
- Supports Docker, Singularity & other runtimes

Run Anywhere
- Bare metal, VMs, Kubernetes
- x86, ARM, POWER
- Multi-cloud, on-prem, hybrid, edge

NGC Deep Learning Containers

CONVERSATIONAL AI	HEALTHCARE	SMART CITIES	TELECOM	AUTONOMOUS DRIVING	ROBOTICS	HPC
Riva	CLARA	DEEPSTREAM & SMART PARKING	AERIAL	DRIVE	ISAAC	HPC SDK

Learn more about NGC Containers

NEXT STEPS FOR THIS CLASS

Catalog: Containers / **Containers: nvidia:dli-dl-fundamentals**

DLI Deep Learning Fundamentals Course -...

Publisher	**Built By**	**Latest Tag**	**Modified**	**Size**
NVIDIA	NVIDIA	v0.0.1	October 27, 2020	4.19 GB

Multinode Support   **Multi-Arch Support**
No   ⊗

Description

Base environment used in the NVIDIA Deep Learning Institute (DLI) Course Fundamentals of Deep Learning, along with Next Steps project.

Labels

| Computer Vision | DLI | Jupyter | Machine Learning | Machine Learning & AI |

Pull Command

```
docker pull nvcr.io/nvidia/dli-dl-fundamentals:v0.0.1
```

Step 1 Setup Docker

https://www.docker.com/

Step 2 Visit NGC Catalog

https://catalog.ngc.nvidia.com/orgs/nvidia/containers/dli-dl-fundamentals

Step 3 Pull and Run Container

Visit localhost:8888 to check out a JupyterLab environment with a Next Steps Project

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NVIDIA

CLOSING THOUGHTS

COPYING ROCKET SCIENCE

LET'S GET STARTED!

NVIDIA DEEP LEARNING INSTITUTE