

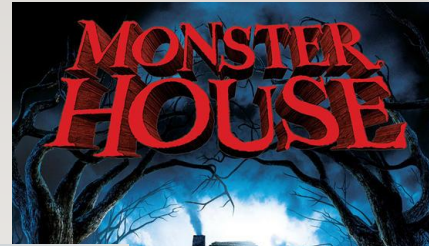
THE STATE OF **ANIMATION** IN **GAMES**

SCAD: INTERVIEW PRESENTATION V06

NYE WARBURTON

07/02/20

HELLO!
MY NAME IS
NYE!



>GIT CLONE
HTTP://GITHUB.COM/NYEGUY/STATEANIMATIONGAMES

PRESENTATION

RIGS / ANIMATION

**LINKS AND REFERENCE
BY SLIDE**

POWERPOINT3

AUTODESK MAYA 2019

UNREAL ENGINE 4.24

OPEN BROADCAST SOFTWARE 25.0.04

THE STATE OF ANIMATION IN GAMES

REAL TIME

**ANIMATION
DATA** (AVATARS)

CINEMATICS
(SAND BOX AND
CUT SCENES)

**NEURAL
NETWORKS**
("THEY'RE HERE.")



ANIMATION

NARRATIVE



ANIMATION DATA

AVATAR

CHARACTER MESH

CHARACTER RIG

CHARACTER CONTROL

CARTESIAN COORDINATE
SYSTEM

X,Y,Z

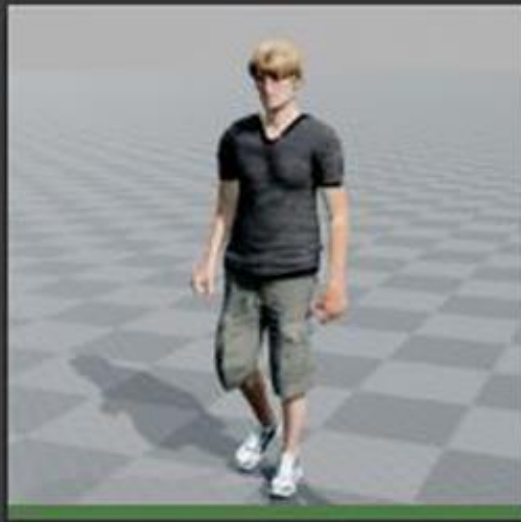
RETARGETING



VELOCITY



A_nye_idle_60fps



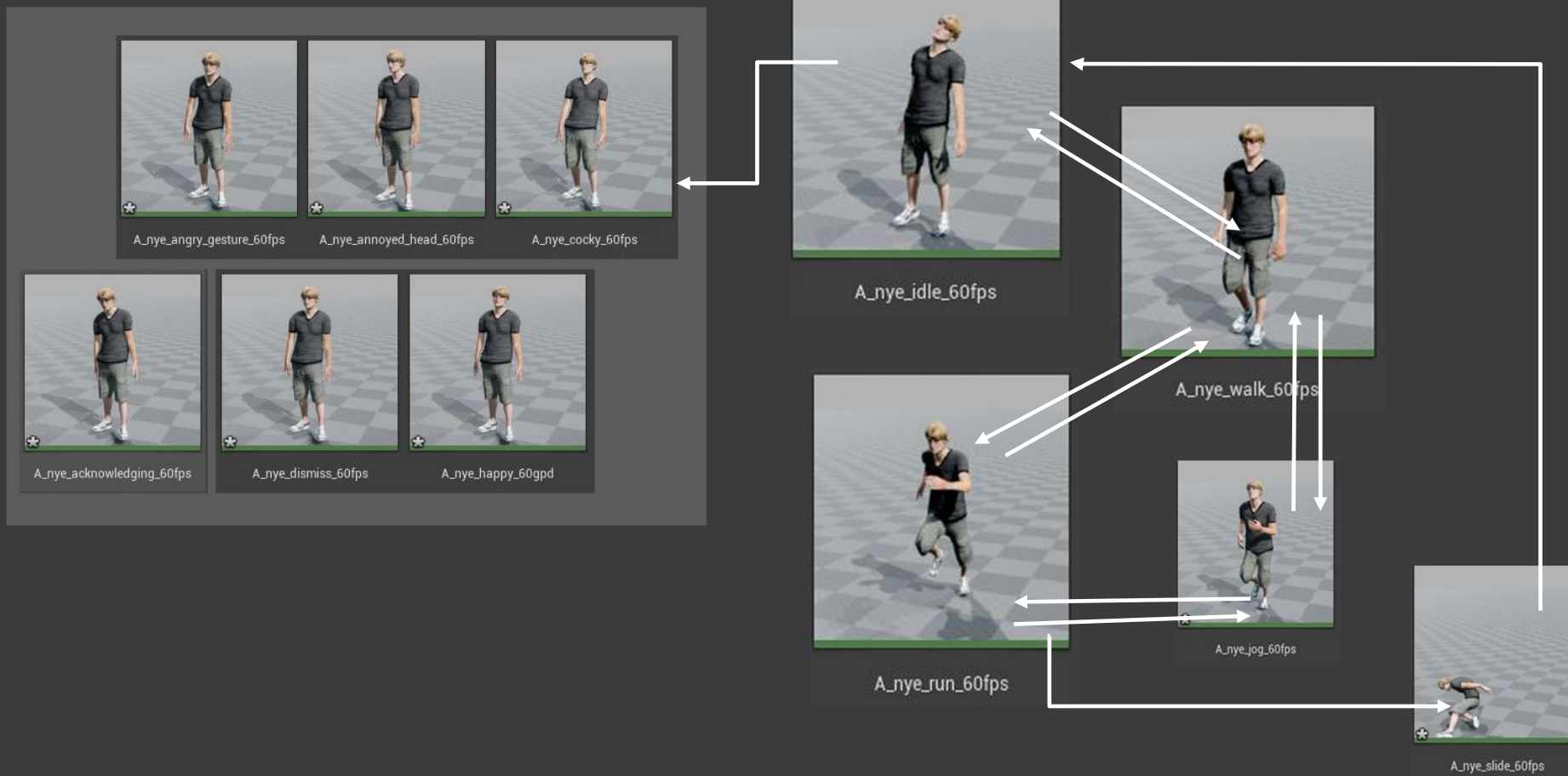
A_nye_walk_60fps



A_nye_run_60fps

STATE MACHINE

A_nye_Idle_Gesture



SANDBOX

JUST DO IT!

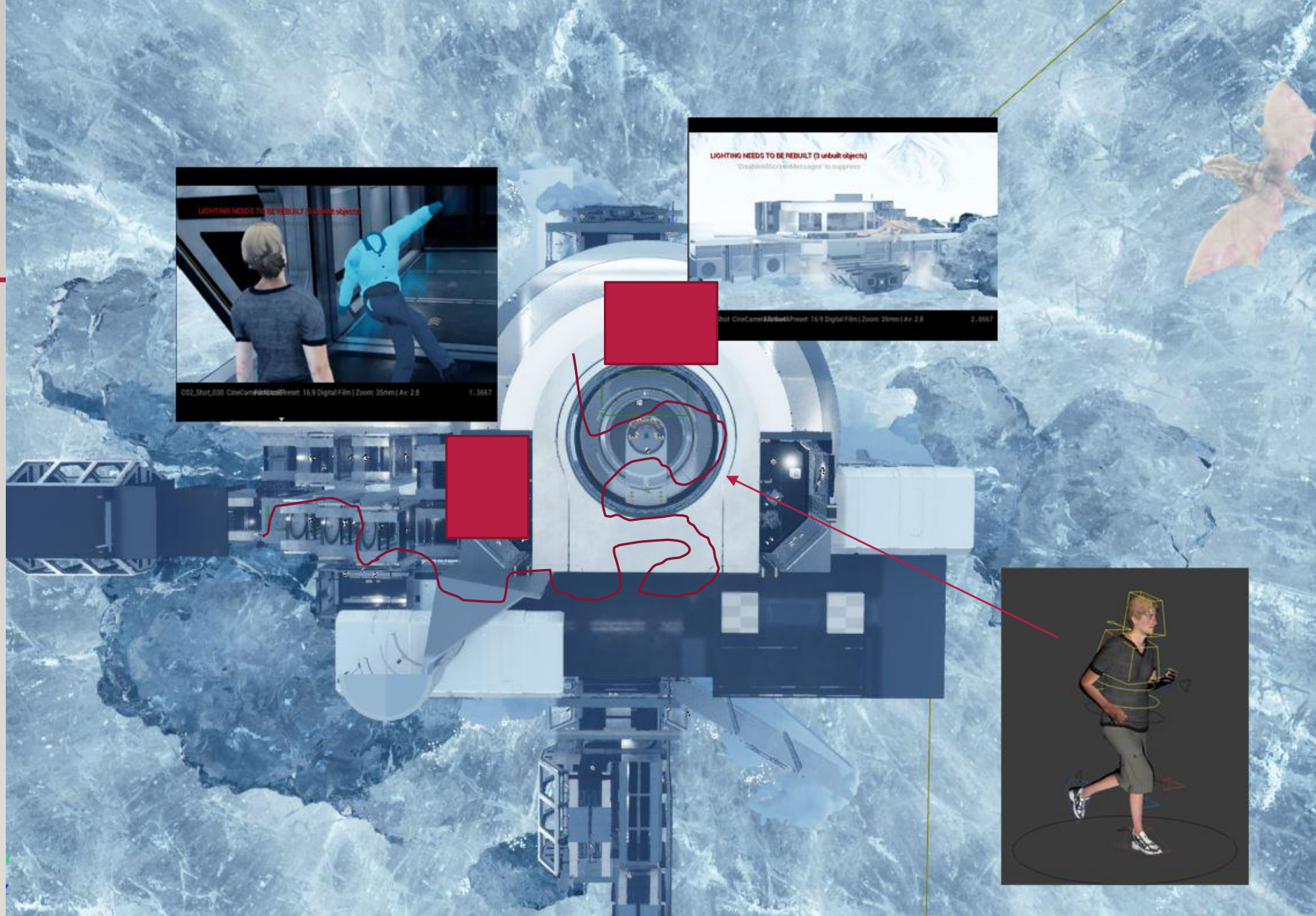
BREAK IT!

TRY IT!

NO FEAR!

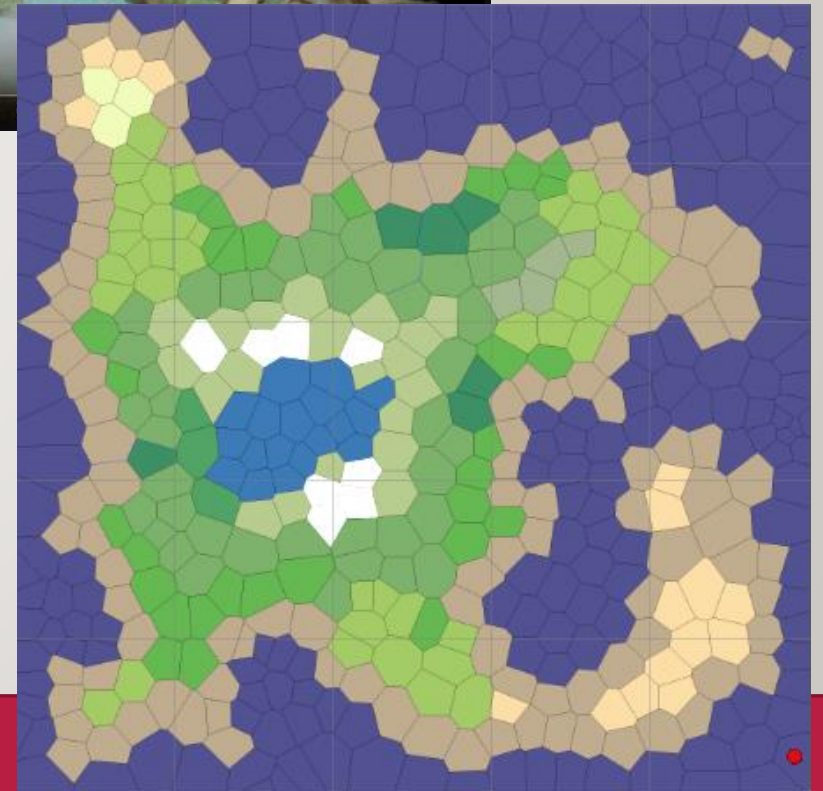


CINEMATICS



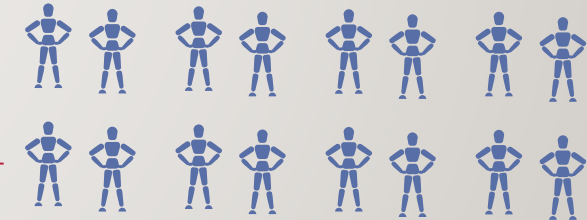
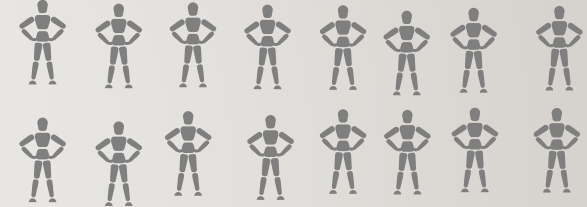
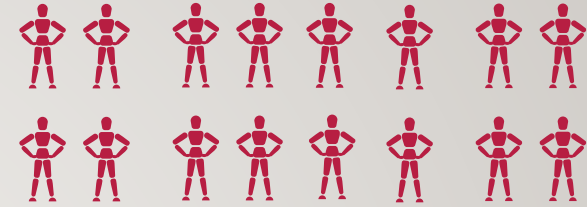
PERSISTENT WORLD?

NARRATIVE SYSTEMS

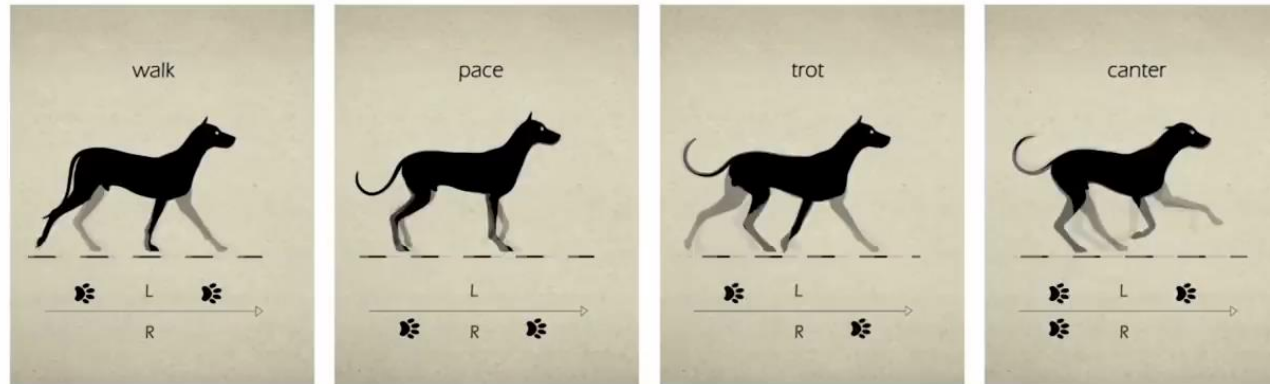


ANIMATION SYSTEMS

(RUNNING, COMBAT, ACTING,
FLYING, DANCING, POKER
PLAYING?)



Quadruped Locomotion Patterns



Courtesy of Stephen Cunnane

Mode-Adaptive Neural Networks for Quadruped Motion Control

HE ZHANG[†], University of Edinburgh
SEBASTIAN STARKE[†], University of Edinburgh
TAKU KOMURA, University of Edinburgh
JUN SAITO, Adobe Research



Fig. 1. A selection of results using our method for quadruped animation. We show some different modes for sitting, turning trot, pace, canter, jumping and standing from left to right. The locomotion gaits are not labeled individually, but naturally produced by the movement velocity control.

Quadruped motion includes a wide variation of gaits such as walk, pace, trot and canter, and actions such as jumping, sitting, turning and idling. Applying existing data-driven character control frameworks to such data requires a significant amount of data preprocessing such as motion labeling and alignment. In this paper, we propose a novel neural network architecture called Mode-Adaptive Neural Networks for controlling quadruped characters. The system is composed of the motion prediction network and the gating network. At each frame, the motion prediction network computes the character state in the current frame given the state in the previous frame and the user-provided control signals. The gating network dynamically updates the weights of the motion prediction network by selecting and blending what we call the expert weights, each of which specializes in a particular movement. Due to the increased flexibility, the system can learn consistent expert weights across a wide range of non-periodic/periodic actions, from unstructured motion capture data, in an end-to-end fashion. In addition, the users are released from performing complex labeling of phases in different gaits. We show that this architecture is suitable for encoding the multi-modality of quadruped locomotion and synthesizing responsive motion in real-time.

CCS Concepts: • Computing methodologies → Motion capture; Neural networks;

[†] He Zhang and Sebastian Starke are joint first authors.

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Additional Key Words and Phrases: neural networks, locomotion, human motion, character animation, character control, deep learning

ACM Reference Format:

He Zhang[†], Sebastian Starke[†], Taku Komura, and Jun Saito. 2018. Mode-Adaptive Neural Networks for Quadruped Motion Control. *ACM Trans. Graph.* 37, 4, Article 145 (August 2018), 11 pages. <https://doi.org/10.1145/3197517.3201366>

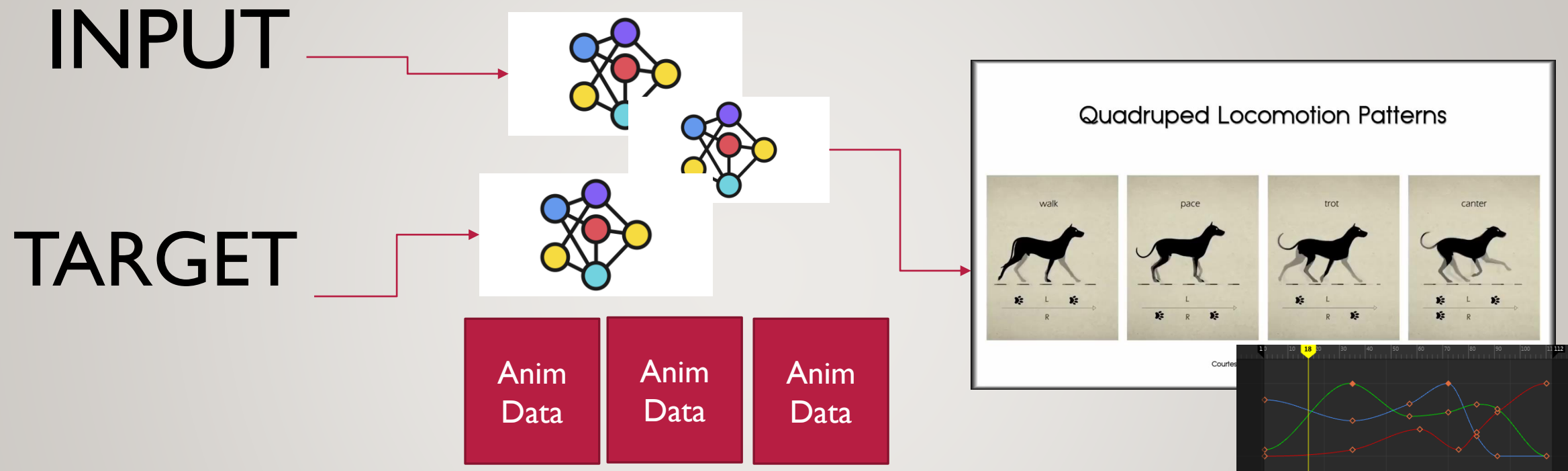
1 INTRODUCTION

Quadruped animation is one of the unsolved key problems in computer animation. It has particular relevance for applications in computer games and films, and also presents a challenging topic in robotics. When animating quadrupeds, animators must go through special training to design a wide range of complex movements. This complexity is inherently from the multi-modality of quadruped motions. For example, there are a number of locomotion modes¹ including walk, pace, trot, canter, and gallop, where the movements and the phases of the torso and limbs vary in a complex manner (see Fig. 2).

To the best of our knowledge, there is no prior work on systematically constructing quadruped motion controllers in a data-driven fashion. This difficulty stems from the complexity mentioned above, along with the issue that quadruped animals cannot be directed like humans for a controlled data acquisition. As a result, the captured

NEURAL NETWORKS

MACHINE LEARNING TOOLS FOR ANIMATORS?



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UNITY – ML AGENTS

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MUNIT

Image Translation

MUNIT: Faces to Flowers

Commercial Use

1.7k Runs



BAHAT

Segmentation

Remove background from photos

Commercial Use

950 Runs



INPAINT

Inpainting

High resolution image inpainting

Non-Commercial Use

270 Runs



MDU2

Estimate depth

Commercial Use



YOLOv4

Object Detection

YOLOv4 trained on Vintage Travel Posters dataset

Custom License

72 Runs



YOLOv4

Object Detection

Optimal Speed and Accuracy of Object Detection

Custom License

124 Runs



Person Segmentation

Segmentation

Extract people from images

Commercial Use

445 Runs



YOLOv4

Remove background from photos

Commercial Use



THE STATE OF **ANIMATION** IN GAMES

REAL TIME

**ANIMATION DATA
(AVATARS)**

**CINEMATICS
(SAND BOX-
PERSISTENT
WORLDS)**

NEURAL NETWORKS

NYE'S READING LIST

(EVERYONE CARRIES A SKETCHBOOK)

ANIMATION

- *"THE ANIMATOR'S SURVIVAL KIT"*, WILLIAMS
- *"ILLUSION OF LIFE"*, THOMAS & JOHNSON

FILM

- *"FILM DIRECTING SHOT BY SHOT"*, KATZ
- *"HERO OF 1000 FACES"*, CAMPBELL
- *"STORY"*, MCKEE

GAME DEVELOPMENT

- *"3D MATH PRIMER FOR GRAPHICS AND GAME DEVELOPMENT"*, DUNN & PARBERRY
- *"GAME PROGRAMMING PATTERNS"*, NYSTROM
- *"DESIGNING GAMES"*, SYLVESTER

INTELLECTUAL PROPERTY AND IDEAS

- *"THE MEDIUM IS THE MESSAGE"*, MCLUHAN
- *"THE BLACK SWAN"*, TALIB
- *"POSTCAPITALISM"*, MASON

GREAT IDEAS
COMES FROM
“INSANE”
AMOUNTS OF
ITERATION.

-NYE

NEW AIRCRAFT ARE DESIGNED AND TESTED VIRTUALLY, ON A
SUPERCOMPUTER.

‘WHEN WE DESIGNED THE TAIL FIN OF THE TORNADO FIGHTER WE DID
TWELVE STRESS CASES ON IT,’ ONE VETERAN ENGINEER TOLD ME. ‘WITH
ITS REPLACEMENT THE TYPHOON, WE DID 186 MILLION.’

(POSTCAPITALISM, CHAPTER 5, PART 2, PAUL MASON 2015, P. 110)

THE STATE OF ANIMATION IN GAMES

THANK YOU!

[HTTP://GITHUB.COM/NYEGUY/STATEANIMATIONGAMES](http://github.com/nyeguy/stateanimationgames)

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@NYEWARBURTON