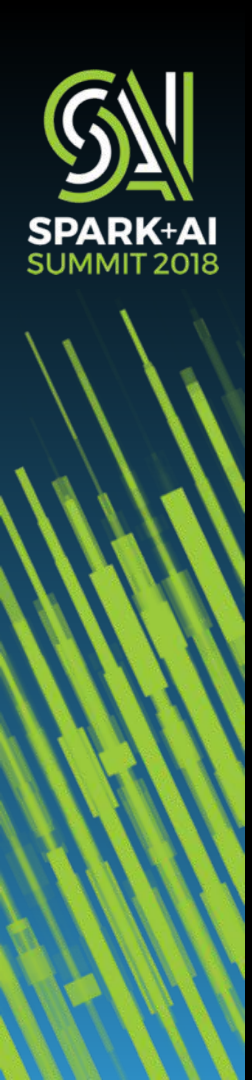


Real-Time In-Flight Drone Route Optimization with Apache Spark

Gary Nakanelua, Blueprint Technologies
Steve Hastings, Blueprint Technologies

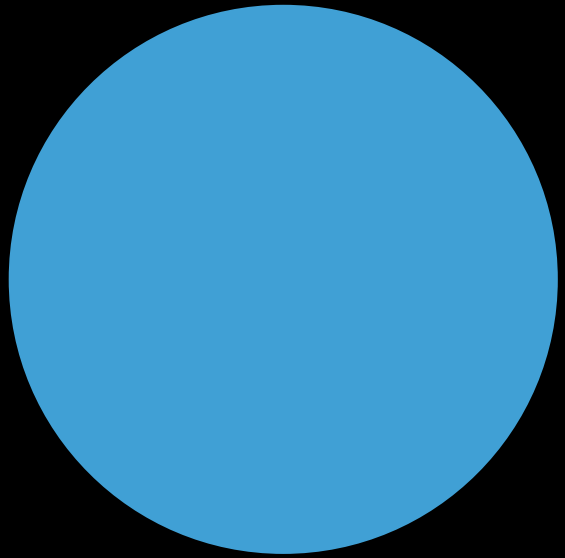
#ExpSAIS17


STEVEN SPIELBERG
READY PLAYER ONE


POWER GLOVE
VIRTUAL BOY
VIRTUAL BOY

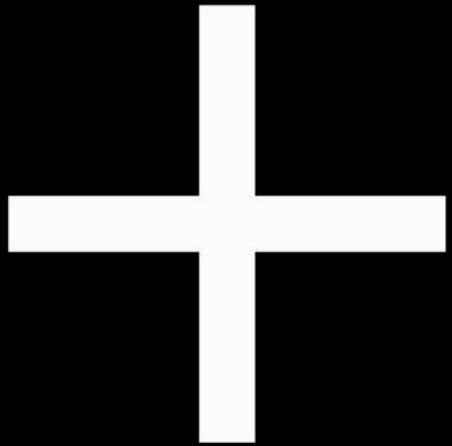

Blueprint

Three Motivations for the Digital Future



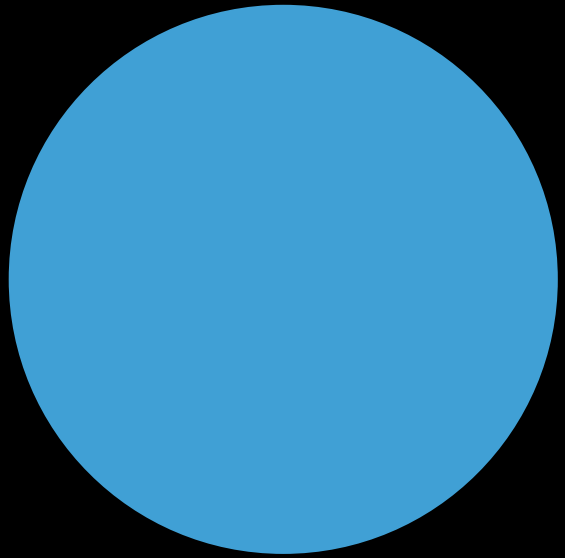
Coolness

Elimination



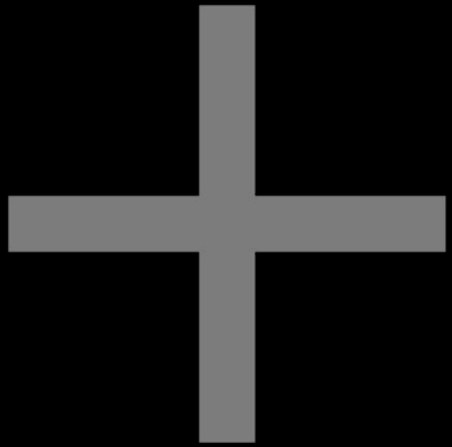
Connection

Three Motivations for the Digital Future



Coolness

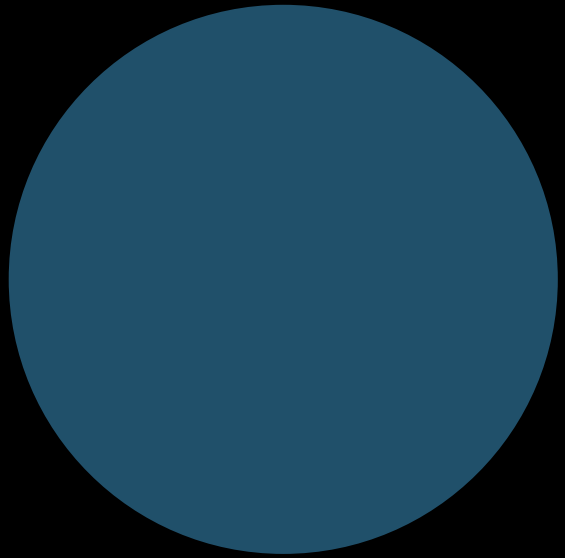
Elimination



Connection

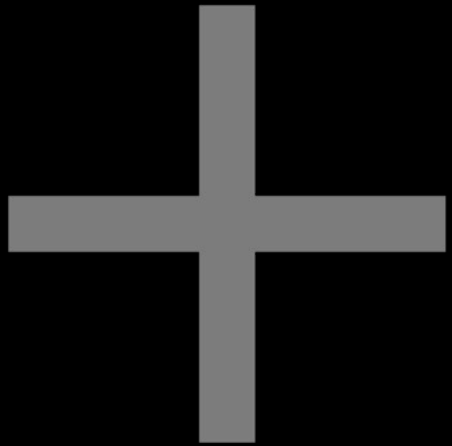

http://www.realdronesimulator.com

Three Motivations for the Digital Future



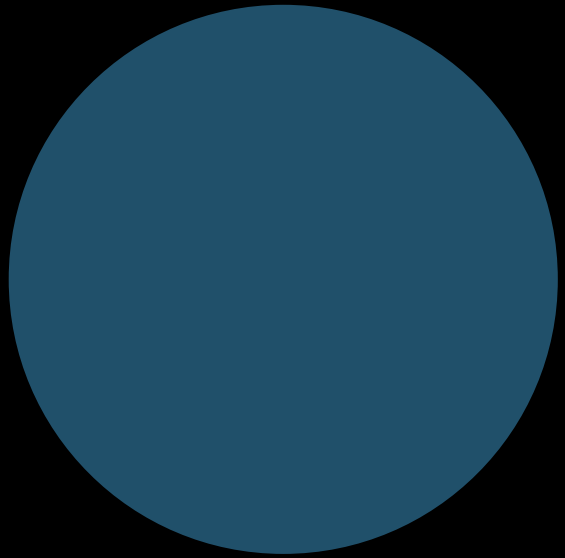
Coolness

Elimination



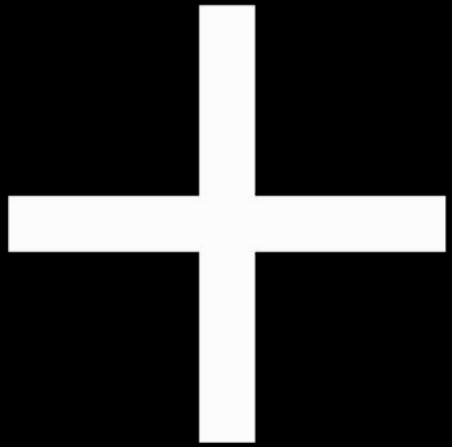
Connection

Three Motivations for the Digital Future



Coolness

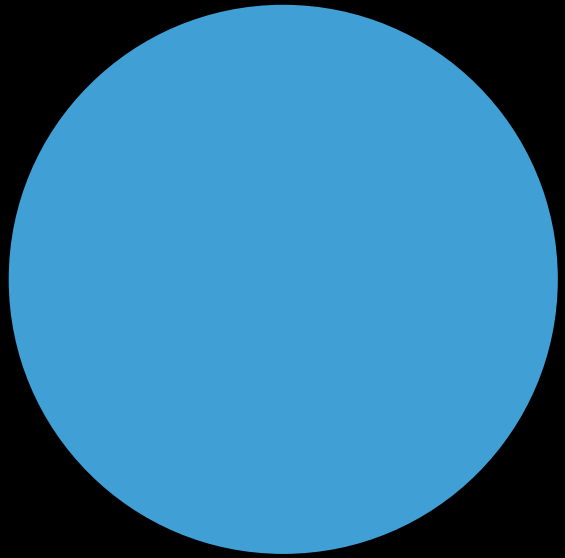
Elimination



Connection


TWITTER
FACEBOOK
GOOGLE
L
R
HR
TEMP
OXY
BPM
STEP
STOCKS

Three Motivations for the Digital Future



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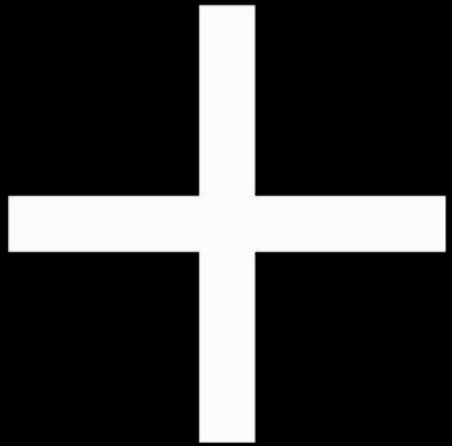


Connection

Digitizing The Oil Field Experiment

How might we advance the use of drones at an oil rig site?

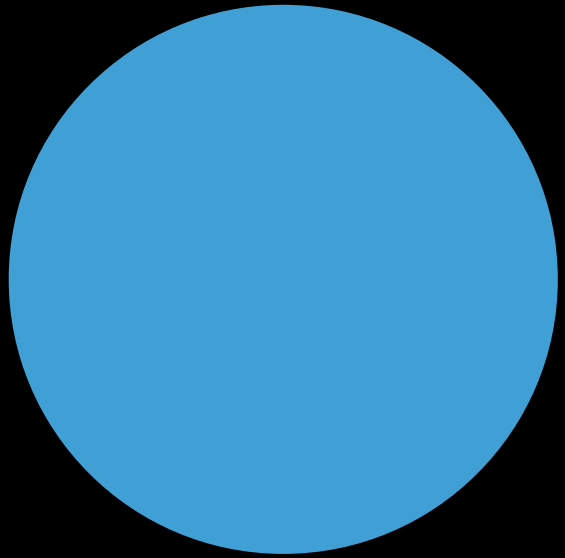
Digitizing The Oil Field Experiment

How might we eliminate the need for scheduled inspections of an oil rig?

Digitizing The Oil Field Experiment

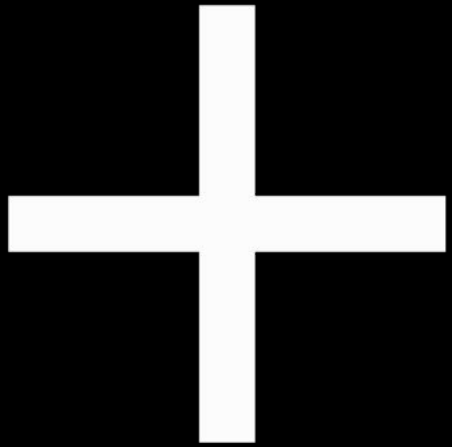
How might we get connected to oil rig data that isn't currently available?

Digitizing The Oil Field Experiment



Drones

Scheduled Inspections



Unavailable Telemetry


Autonomous Drone Flight
Fully automated launch, flight path, and landing


DOOM

Digitizing The Oil Field Experiment

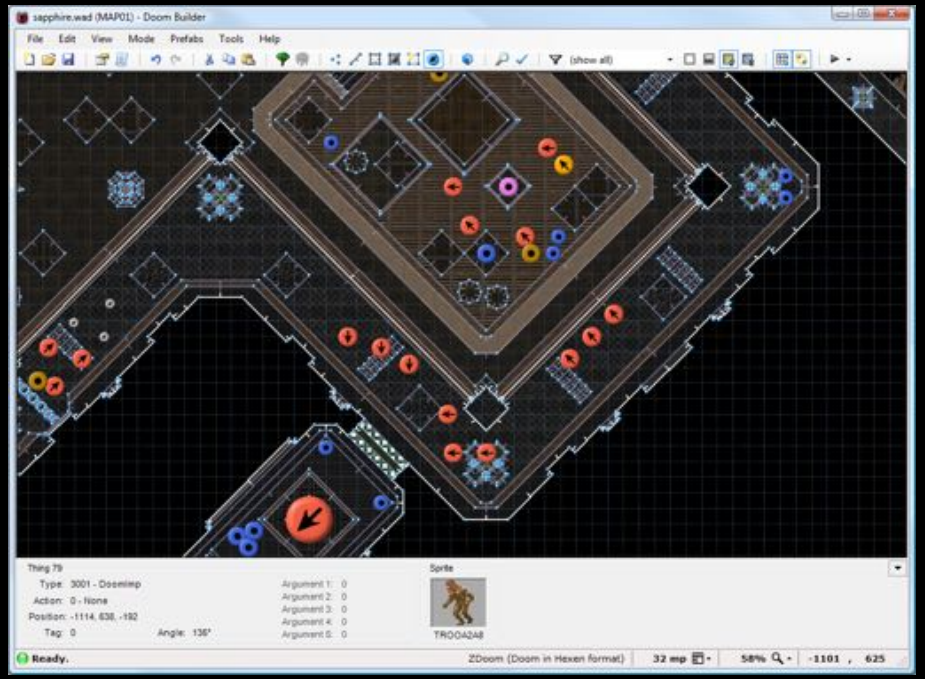
What you are about to see

1. Intro to our learning environment
2. Experimental setup
3. Learning iterations + results + real world analysis
4. Ongoing research at Blueprint

Surprise, This is a Deep Learning Talk

… but this isn’t a technical deep dive.

Enter… ViZDoom



Why Use ViZDoom to Experiment?

Playing Doom **is not** Flying a Drone.

But…

- It is fast and efficient to use
- Bulk of other research using it
- Widely customizable
- Useful parallels to drones (*I promise I will explain*)

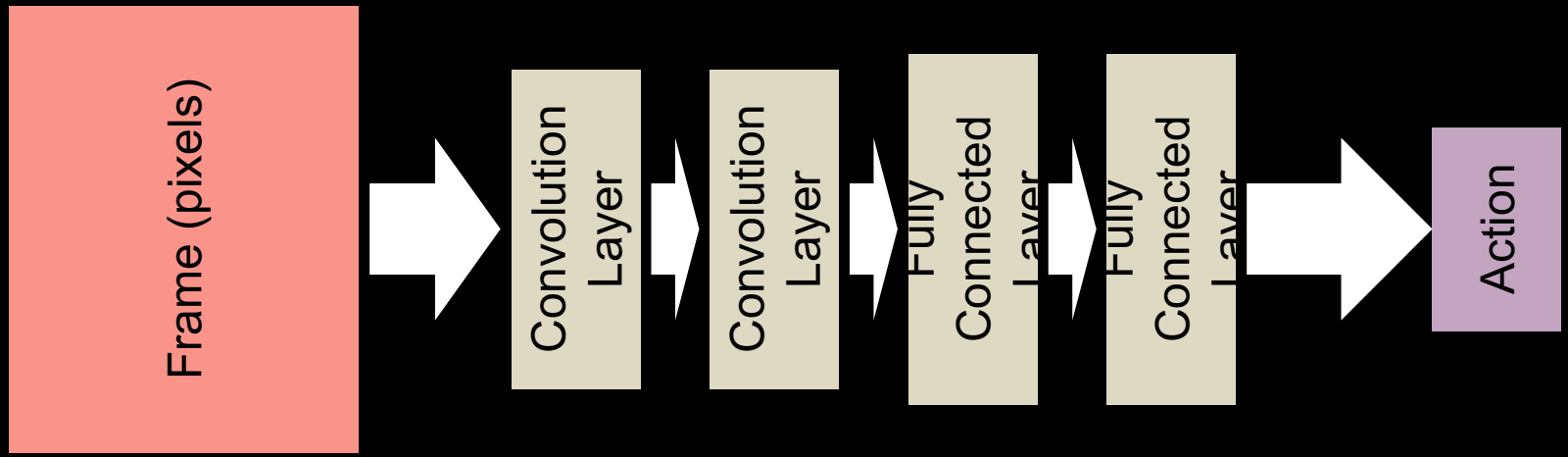
Setup: Scenario

- Large circular map
- Randomly spawned creatures (who move and try to eat our friend's face)

Try to navigate map as long as possible without being attacked and ~~killed~~ defeated by creatures.

Setup: Modelling

Deep Q Network (DQN)



First attempt

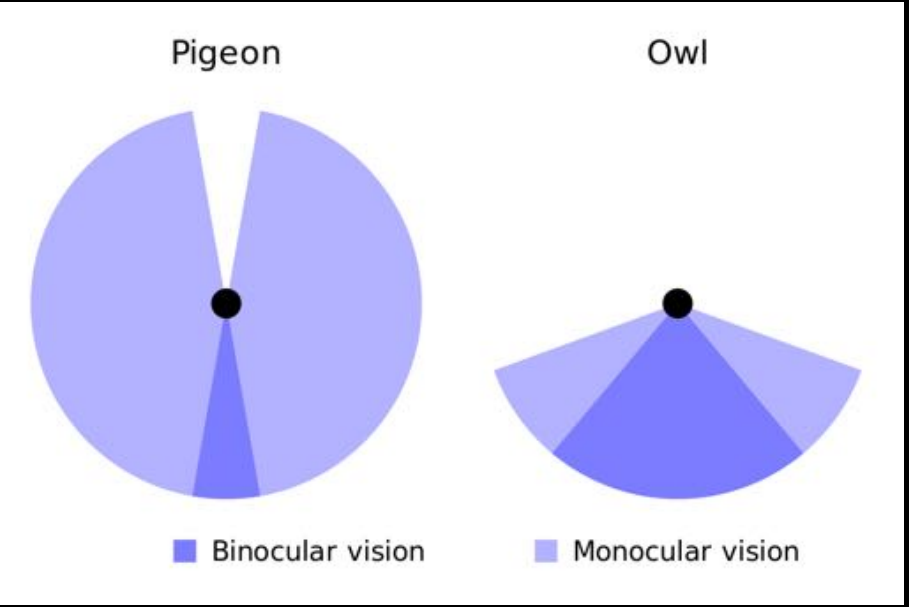
27 seconds

What Happened?

partially observable Markov decision process (POMDP)

Our friend doesn't have
360 degree vision

And thus won't "see" or act
on creatures out of field of view



Iterate

20 seconds

What Happened?

"reward shaping"

Our friend seems to have prioritized spinning in order to be able to see whole environment.

Two ideas of how to fix this.

Iterate

60 seconds
(actually maximum
time possible)

Summary of Important Learnings

As they apply to drones

1. Even simple NN trained with RL can be powerful tools
2. Need to account for partial observability
3. Reward shaping can help inject domain knowledge

Ongoing Research at Blueprint

1. Genetic algorithms
2. Apprenticeship learning
3. Real-world reward shaping
4. Latency

We Are Hiring!

Get Started

https://bit.ly/2HqbZR7

Blueprint™

Win a drone at booth 415!

SPARK+AI SUMMIT 2018

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