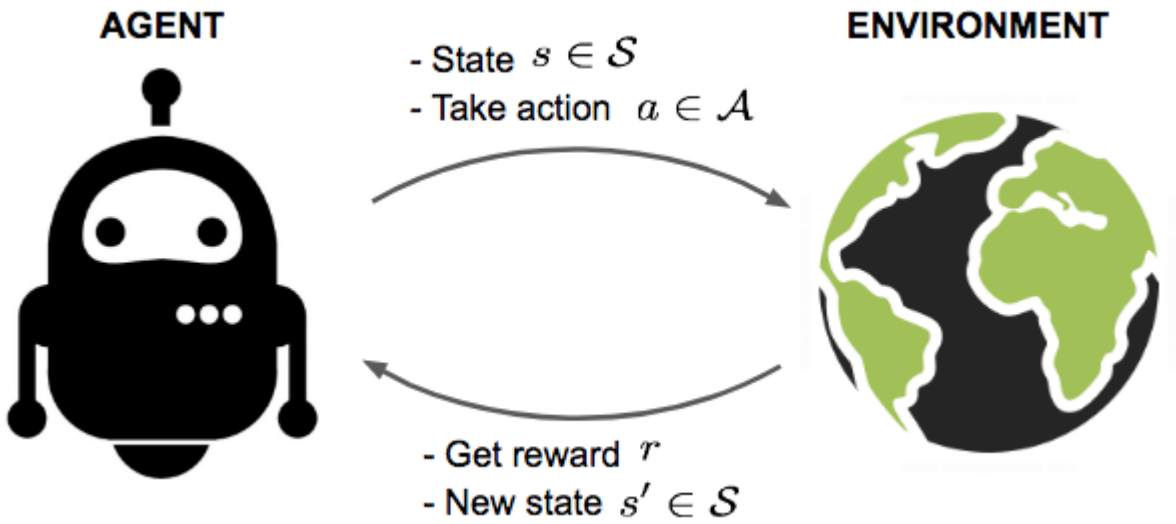
Владислав Куренков, Университет Иннополис

Language Grounding: Recent Advances


AGENT
ENVIRONMENT
- State $s \in \mathcal{S}$
- Take action $a \in \mathcal{A}$
- Get reward r
- New state $s' \in \mathcal{S}$

2017

Gated-Attention Architectures for Task-Oriented Language Grounding

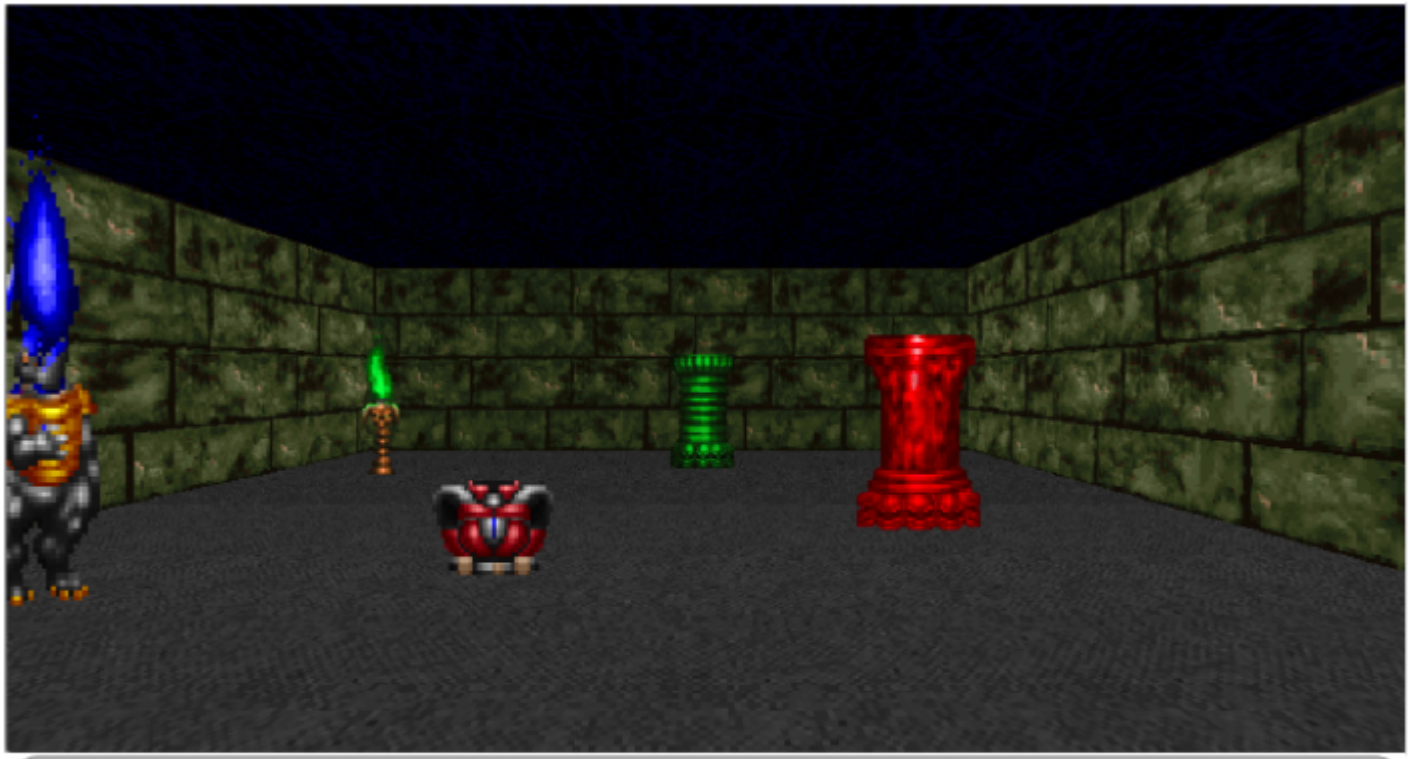
Devendra Singh Chaplot
chaplot@cs.cmu.edu
School of Computer Science
Carnegie Mellon University

Kanthashree Mysore Sathyendra*
ksathyen@cs.cmu.edu
School of Computer Science
Carnegie Mellon University

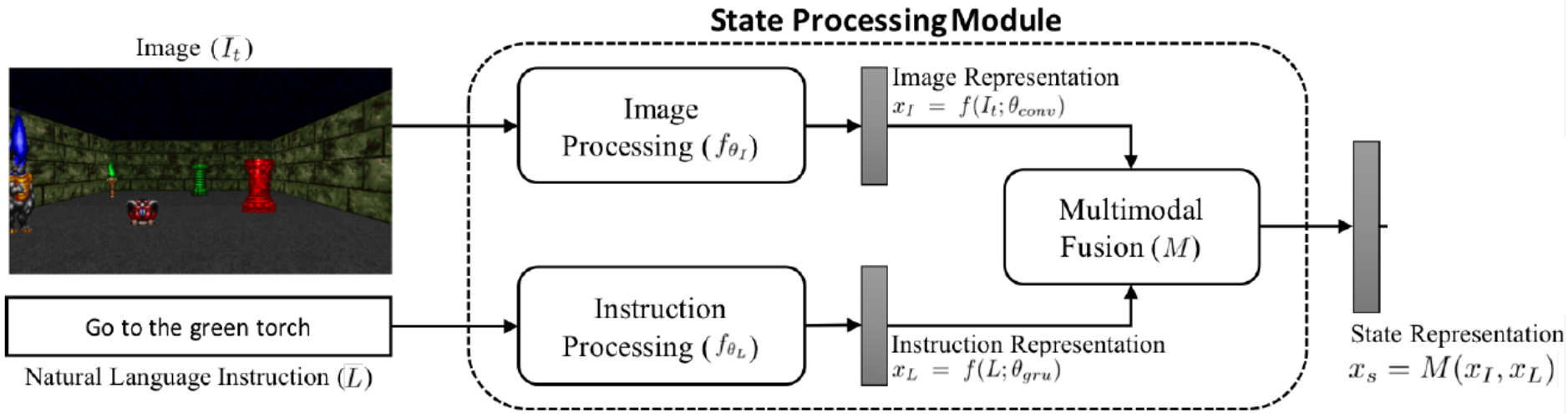
Rama Kumar Pasumarthi*
rpasumar@cs.cmu.edu
School of Computer Science
Carnegie Mellon University

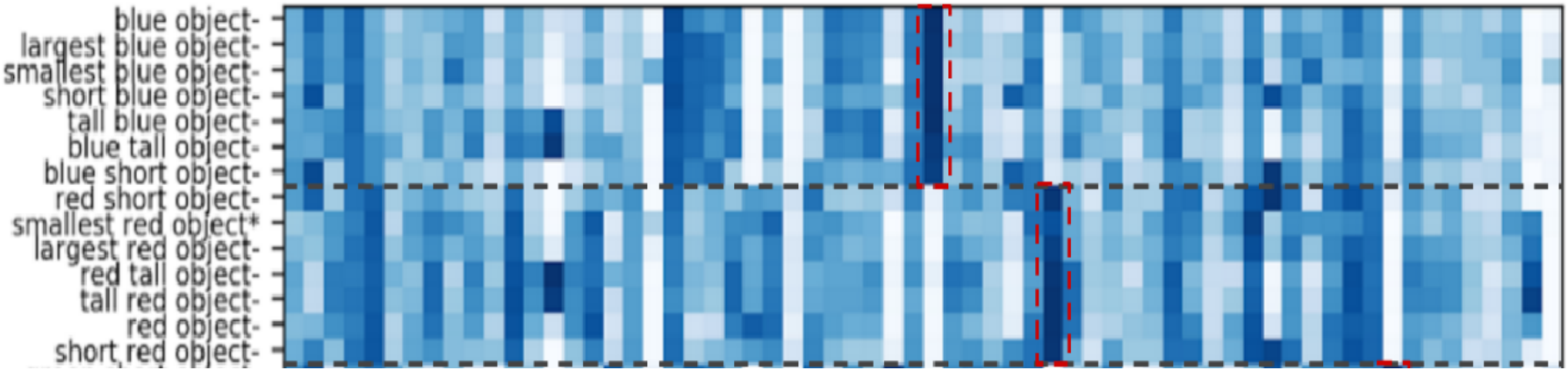
Dheeraj Rajagopal*
dheeraj@cs.cmu.edu
School of Computer Science
Carnegie Mellon University

Ruslan Salakhutdinov
rsalakhu@cs.cmu.edu
School of Computer Science
Carnegie Mellon University



Go to the green torch


State Processing Module
Image (I_t)
Go to the green torch
Natural Language Instruction (L)
Image Processing (f_{θ_I})
Instruction Processing (f_{θ_L})
Image Representation
$x_I = f(I_t; \theta_{conv})$
Instruction Representation
$x_L = f(L; \theta_{gru})$
Multimodal Fusion (M)
State Representation
$x_s = M(x_I, x_L)$


blue object-
largest blue object-
smallest blue object-
short blue object-
tall blue object-
blue tall object-
blue short object-
red short object-
smallest red object*
largest red object-
red tall object-
tall red object-
red object-
short red object-

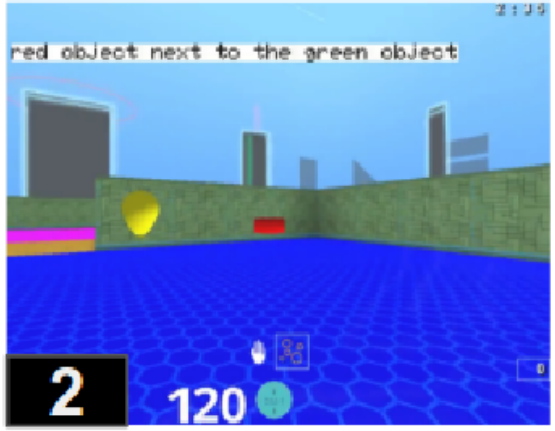
2017

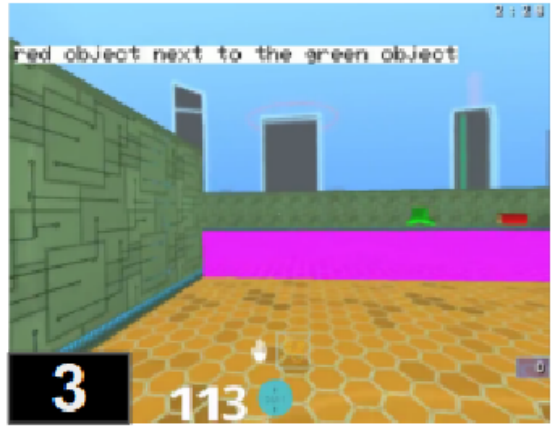
Grounded Language Learning in a Simulated 3D World

Karl Moritz Hermann[*†], **Felix Hill**[*], **Simon Green, Fumin Wang, Ryan Faulkner, Hubert Soyer, David Szepesvari, Wojciech Marian Czarnecki, Max Jaderberg, Denis Teplyashin, Marcus Wainwright, Chris Apps, Demis Hassabis and Phil Blunsom**[†]

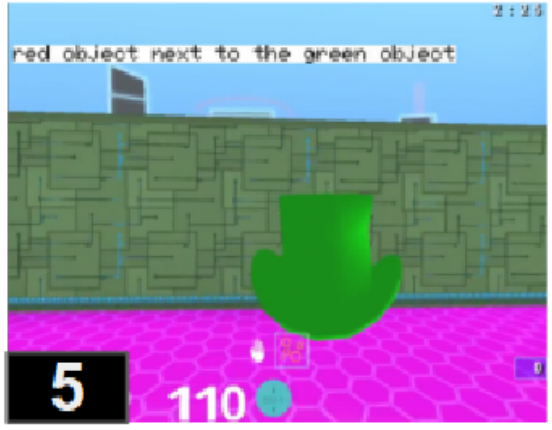
Deepmind
London, UK

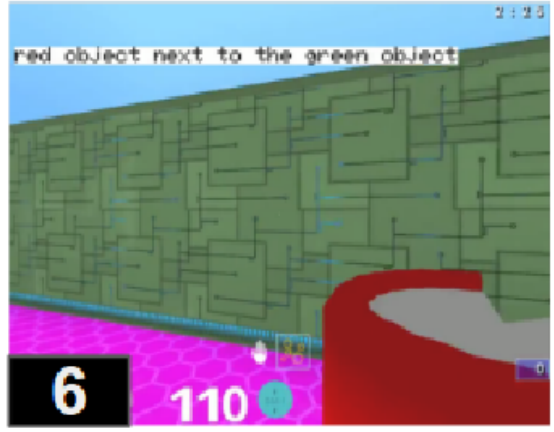
red object next to the green object
1
123

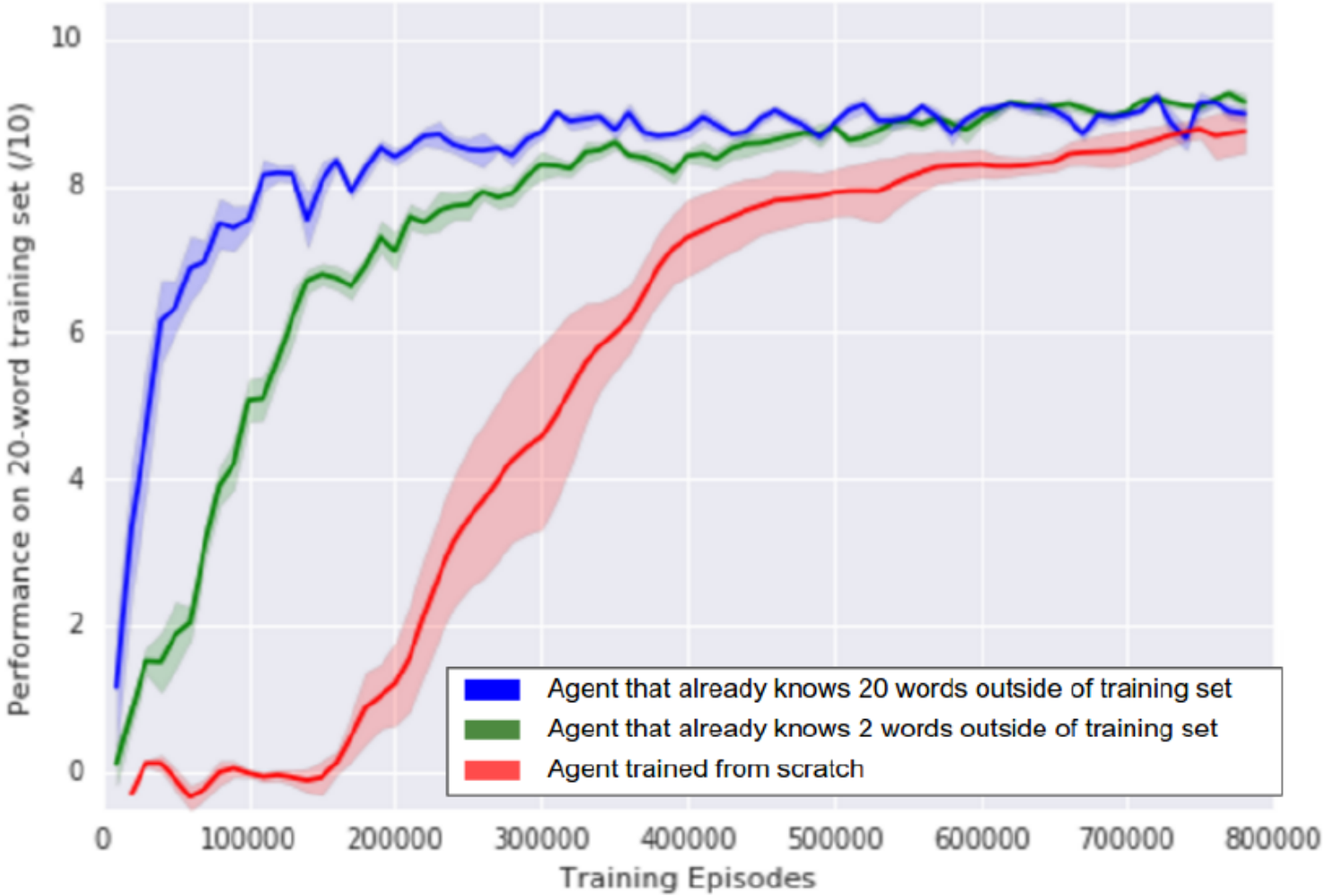

red object next to the green object
2
120


red object next to the green object
3
113

red object next to the green object
4
111

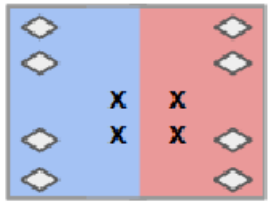

red object next to the green object
5
110


red object next to the green object
6
110


Performance on 20-word training set (/10)
10
8
6
4
2
0
0
100000
200000
300000
400000
500000
600000
700000
800000
Training Episodes
Agent that already knows 20 words outside of training set
Agent that already knows 2 words outside of training set
Agent trained from scratch

single-room layout

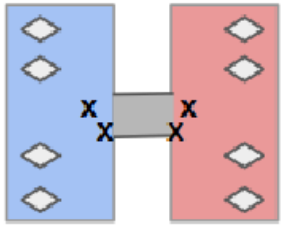
1



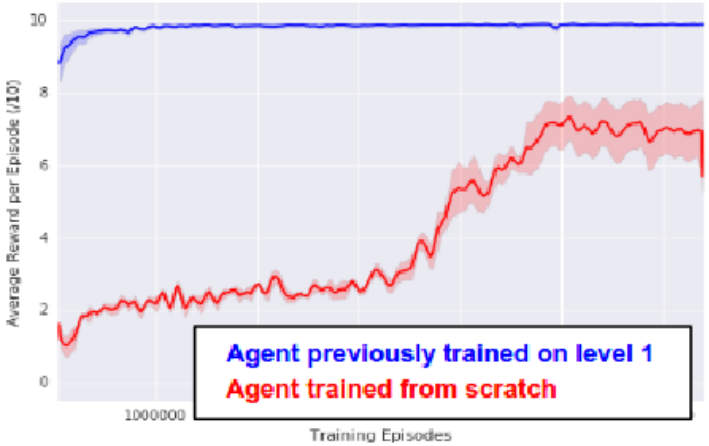
two object words and room descriptors

two room layout

2

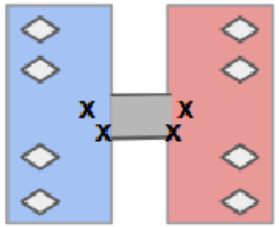


two object words and room descriptors

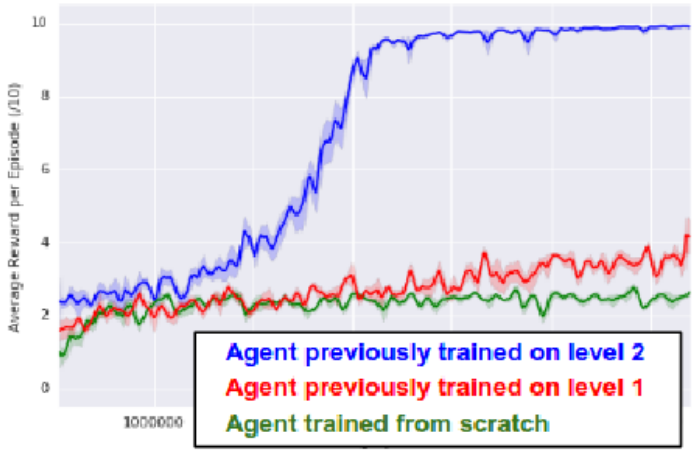


two room layout

3

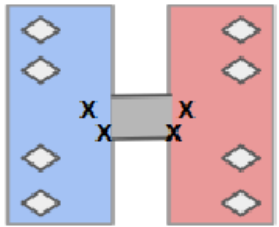


medium
object
word /
room
descriptor
vocabulary



two room layout

4



full
object
word /
room
descriptor
vocabulary

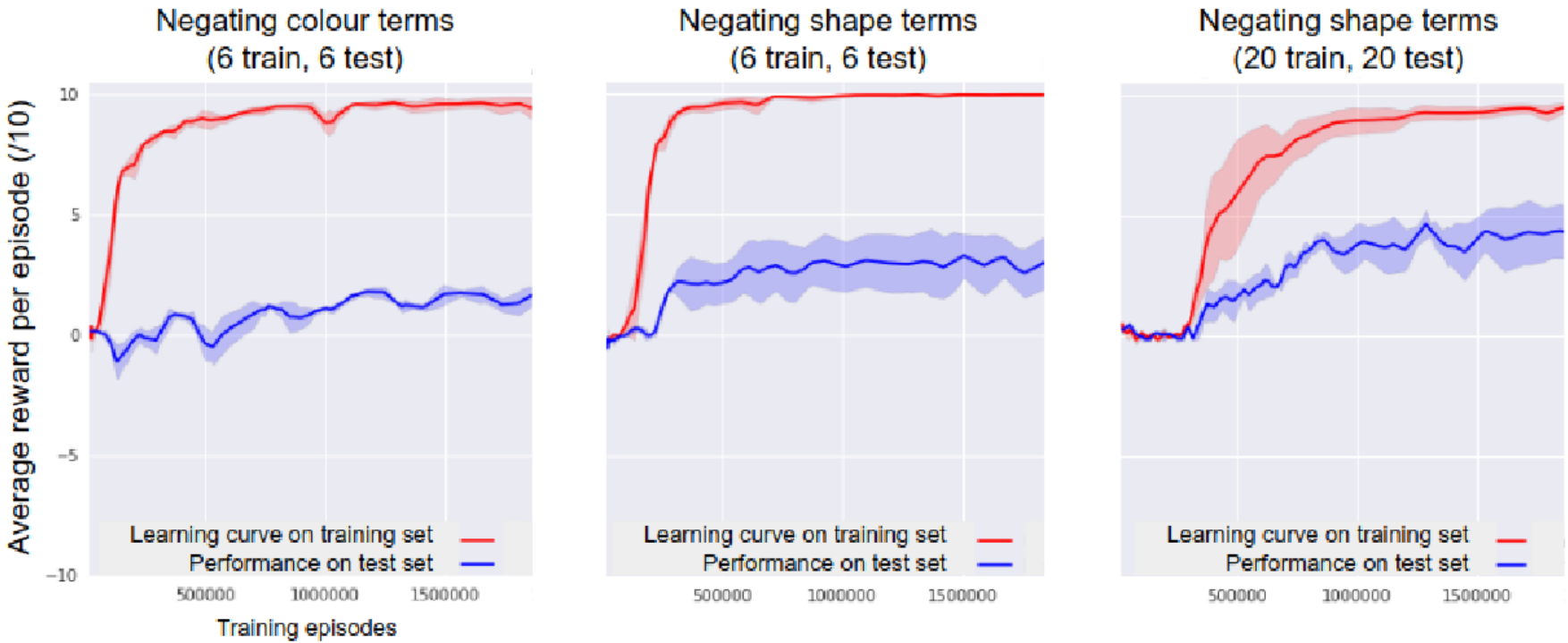
2017

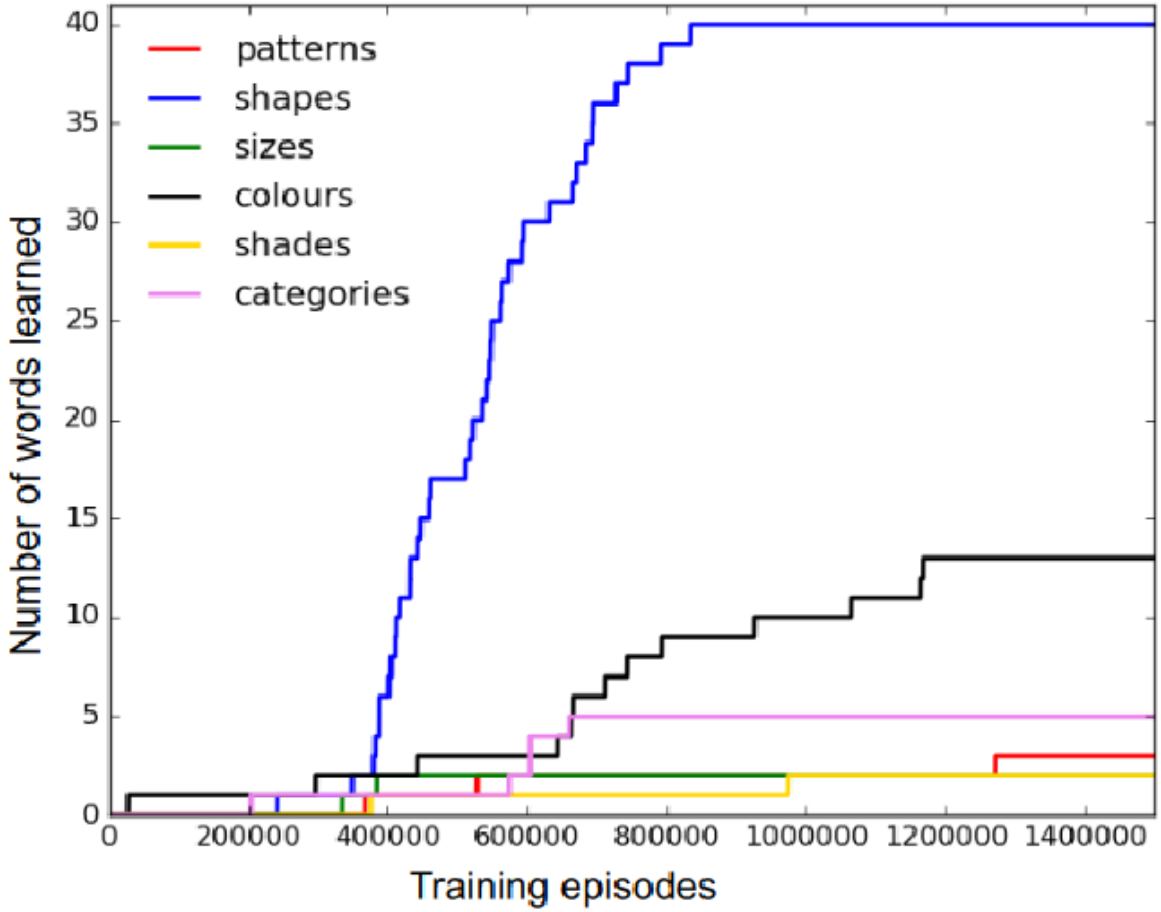
UNDERSTANDING GROUNDED LANGUAGE LEARNING AGENTS

Felix Hill, Karl Moritz Hermann, Phil Blunsom & Stephen Clark
Deepmind
London
{felixhill, kmh, pblunsom, clarkstephen}@google.com

0 shape terms, 8 colour terms
8 shape terms, 8 colour terms
20 shape terms, 0 colour terms
Average reward per episode (/10)
10
5
0
−5
−10
Shape bias
Colour bias
Learning curve on training set
Degree of shape bias
500000
1000000
1500000
Training episodes

Tell me a joke that is not offensive


Negating colour terms
(6 train, 6 test)
Negating shape terms
(6 train, 6 test)
Negating shape terms
(20 train, 20 test)
Average reward per episode (/10)
10
5
0
−5
−10
Learning curve on training set
Performance on test set
500000
1000000
1500000
Training episodes


patterns
shapes
sizes
colours
shades
categories
Number of words learned
Training episodes
0
5
10
15
20
25
30
35
40
0
200000
400000
600000
800000
1000000
1200000
1400000

QA

Владислав Куренков
telegram, linkedin: vvkurenkov

Appendi

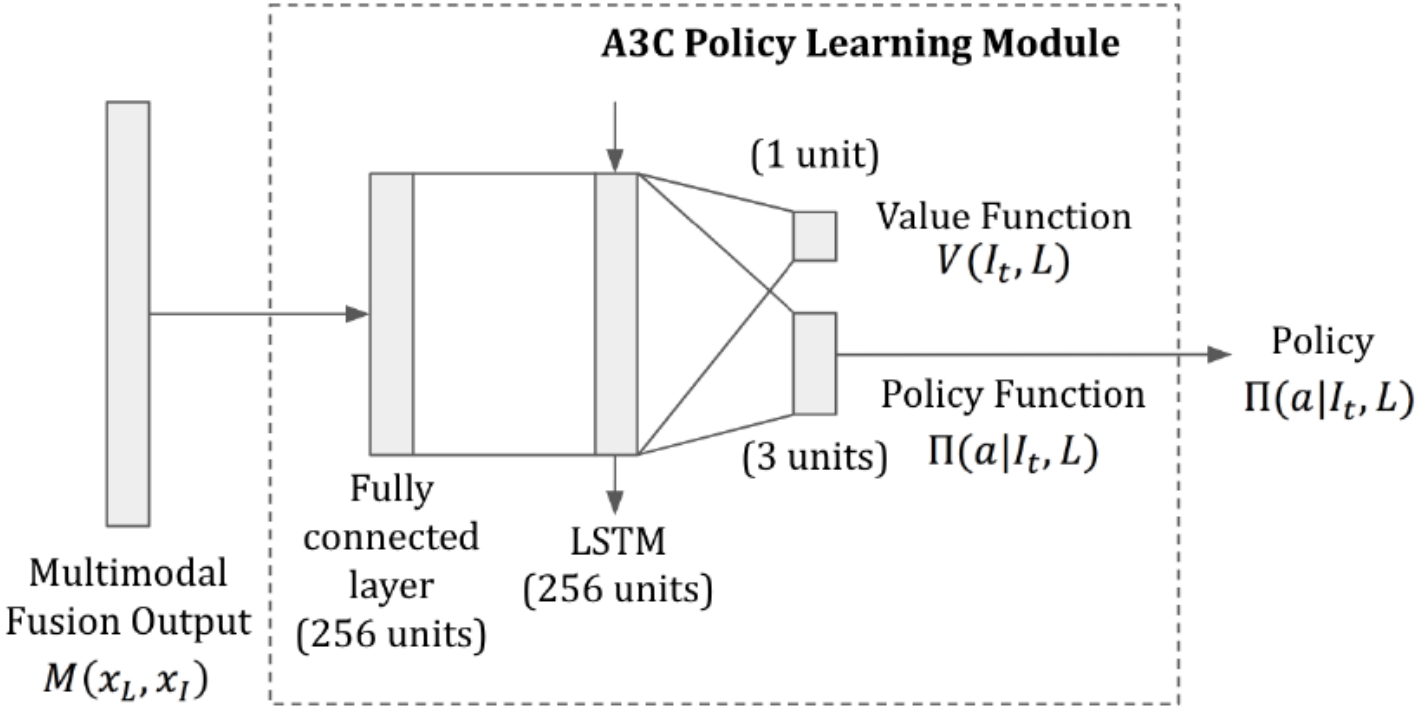


Figure 4: A3C policy model architecture.

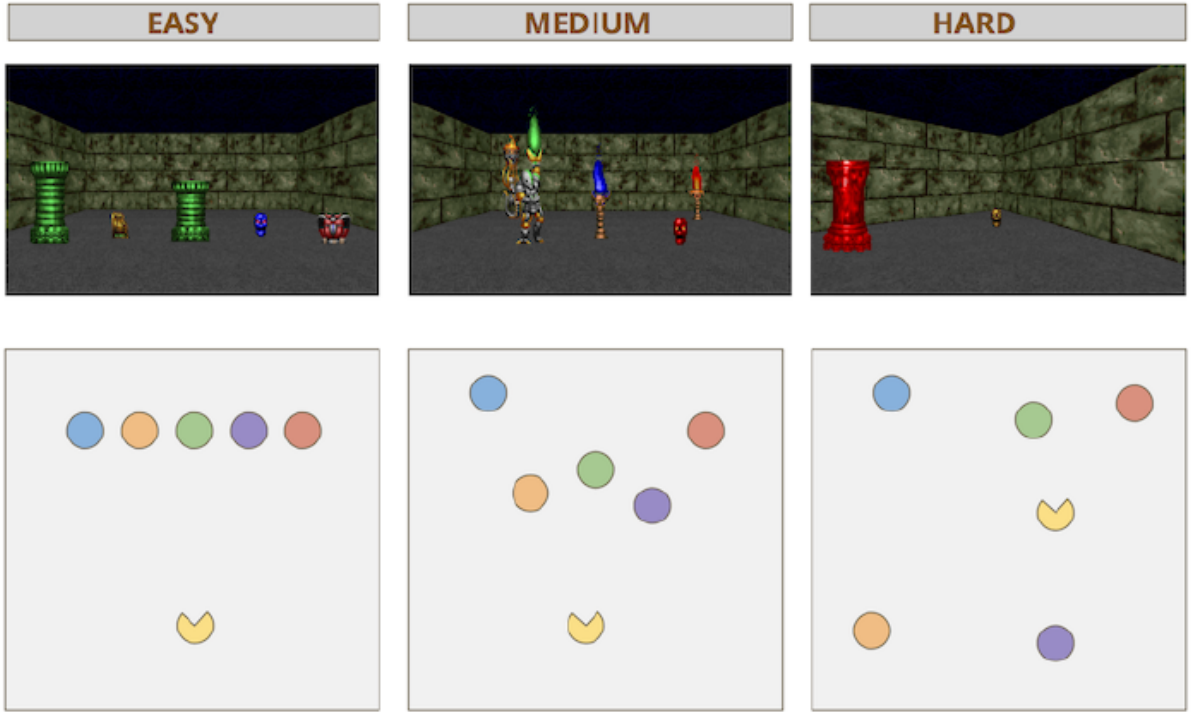
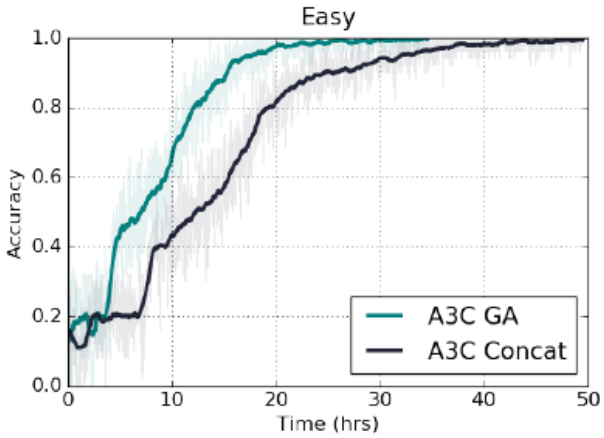
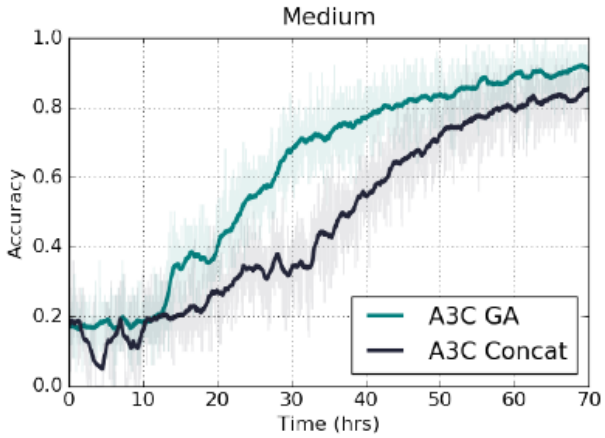
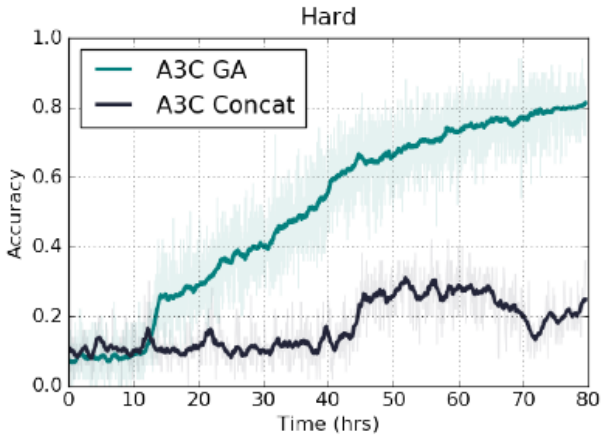
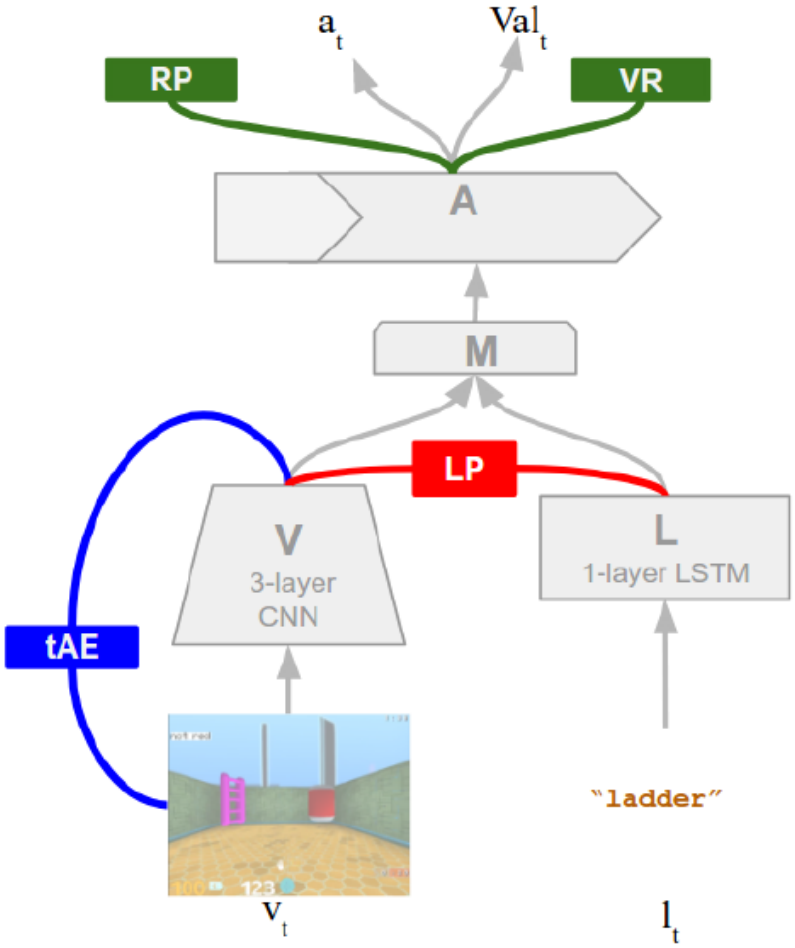


Figure 5: Sample starting states and bird's eye view of the map (not visible to the agent) showing agent and object locations in Easy, Medium and Hard modes.

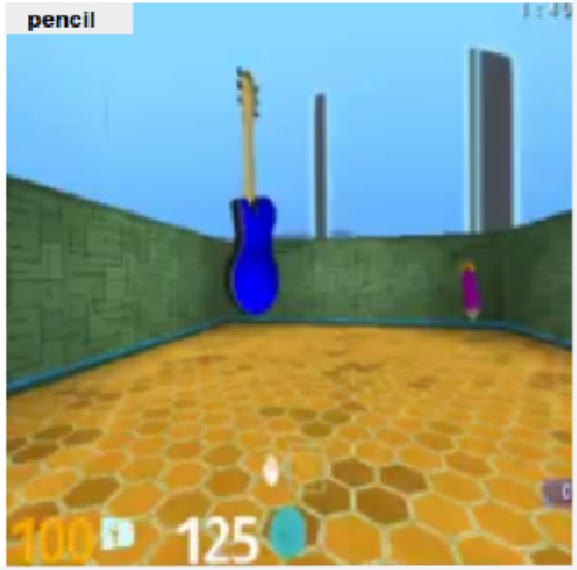

Easy
Accuracy
Time (hrs)
A3C GA
A3C Concat


Medium
Accuracy
Time (hrs)
A3C GA
A3C Concat

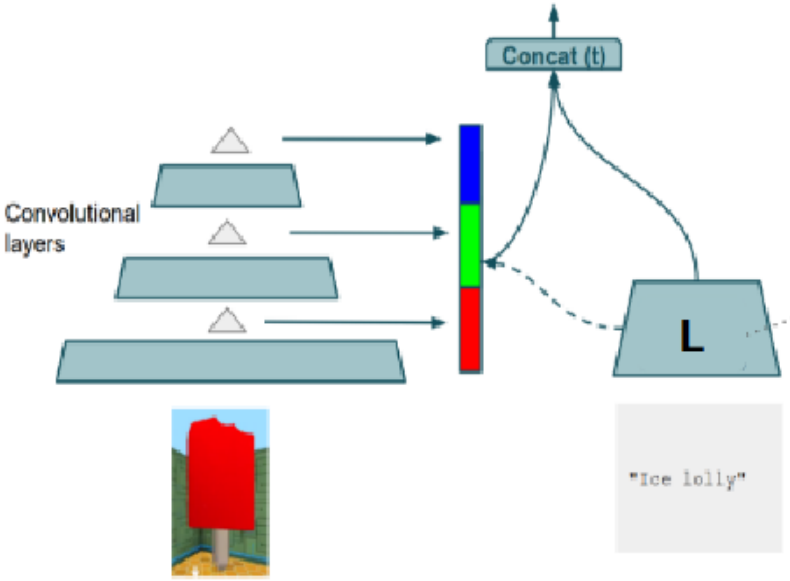

Hard
Accuracy
Time (hrs)
A3C GA
A3C Concat


a_t
Val_t
RP
VR
A
M
LP
V
3-layer
CNN
L
1-layer LSTM
tAE
"ladder"
v_t
l_t

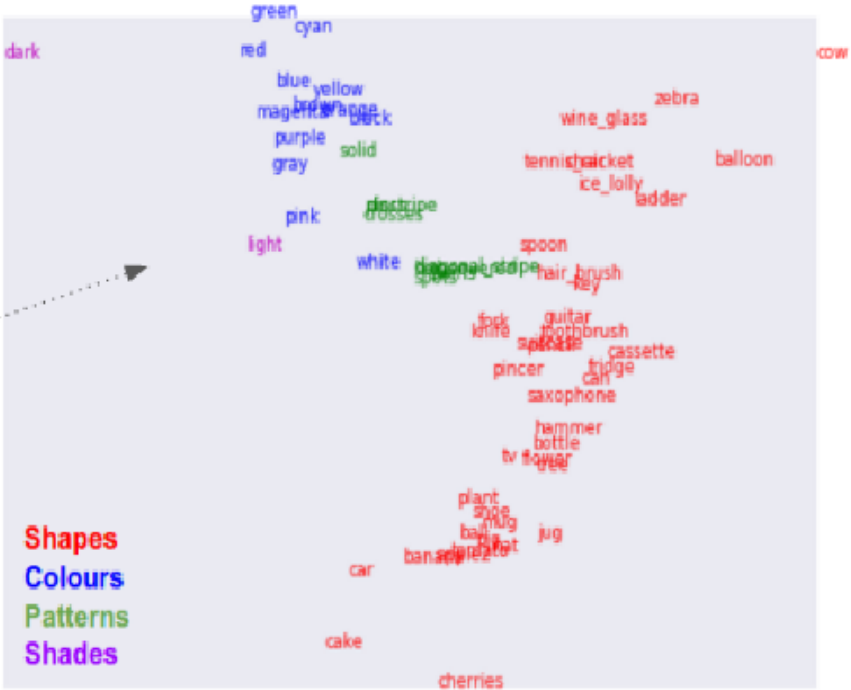
Attention distribution



Attention distribution


Concat (t)
Convolutional layers
L
"Ice lolly"

D


green
cyan
dark
red
cow
blue
yellow
zebra
wine_glass
purple
solid
balloon
gray
ice_lolly
ladder
pink
light
spoon
white
guitar
cassette
pincer
saxophone
hammer
bottle
plant
jug
car
cake
cherries
Shapes
Colours
Patterns
Shades

2017

Emergence of Grounded Compositional Language in Multi-Agent Populations

Igor Mordatch [1] **Pieter Abbeel** [1 2]

2018

INTERACTIVE GROUNDED LANGUAGE ACQUISITION AND GENERALIZATION IN A 2D WORLD

Haonan Yu, Haichao Zhang & Wei Xu
Baidu Research
Sunnyvale, CA 94089, USA
{haonanyu,zhanghaichao,wei.xu}@baidu.com