Undergraduate Thesis 2021

Title

Supervisor Nakajima Tatsuo
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Waseda University
School of Fundamental Science and Engineering
Department of Computer Science

1W17BG08-2 Hu Yong-Hao

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Abstract

This is my abstract...

Acknowledgements

This is my acknowledgements...

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Notations

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Table 1: Mathematical notations

Symbol	Meaning
α	learning rate
γ	discount factor
S, s	state
A, a	action
R, r	reward
τ	a trajectory / an episode
G	return
t	a discrete time step
G_t	return at time step t
T	final time step of an episode
π	policy
π_θ	parametrized policy with parameter θ
$\pi(s)$	the action distribution given state s under policy π
$\pi(a\|s)$	probability of action a given state s under policy π
$\mathbb{E}$	expectation
$\mathbb{E}_\pi$	expectation under policy π
$v(s)$	state value of state S
$v_\pi(s)$	state value of state S under policy π
$q(s, a)$	action value of action a on state s
$q_p i(s, a)$	action value of action a on state s under policy π
σ	activation function

Chapter 1

Introduction

1.1 Motivations

As the pandemic of COVID-19 spreading throughout the world since 2020, people were forced or encouraged to stay home and restricted from accessing public places, including tourist attractions, shops, workplaces, schools, etc. Humans' freedom in physical space is restricted, which accelerate the progress of digitalization. Not only entertainment but more and more economic and even academic activities are moving online. As the pandemic slowing down recently, despite the resumption of some physical activities, there are places or facilities remaining unused or abandoned due to financial problems, amount of users not recovered, digitalization of activities, and so on.

Removing the idle places or facilities is a choice, but if it is possible to give them new values or change people's image of them, they can play different roles and keep contributing the society or enrich the environment. In fact, the concept 'Regional Revitalization', which referes to the attempts to vitalize rural towns where population is falling, by making use of local speciality combined with new ideas to develop new and unique industries such as tourism, has been applied around Japan recently. Among cases of Regional Revitalization, some of them adopt location-based Augmented Reality to help enrich the space. Location-based Augmented Reality is defined as Augmented Reality that utilize geographical information to display contents corresponding to a physical location. It has already used in not merely entertainment, where Pokemon GO is a famous example, but also implemented in tourism and education, which implies its versatility and practicability. With the application of location-based Augmented Reality and the reference of Regional Revitalization, transformation of an idle place or facility without

physical reconstruction seems to be feasible.

1.2 Objectives and importance

RQ Location-based AR

and answer the RQs propose a general model to vitalize an arbitrary place

significant, positive effect

* (Preliminary studies of) Local transformation in general, instead of only tourism or education goals * Use 'people' to comprise the contents, instead of considering specific characteristics of each location * Prove a possibility, instead of focusing on detailed improvement of technology * Future work: combined with improved technology

1.3 Overview of this paper

1.4 Sample section

Sample template [1]

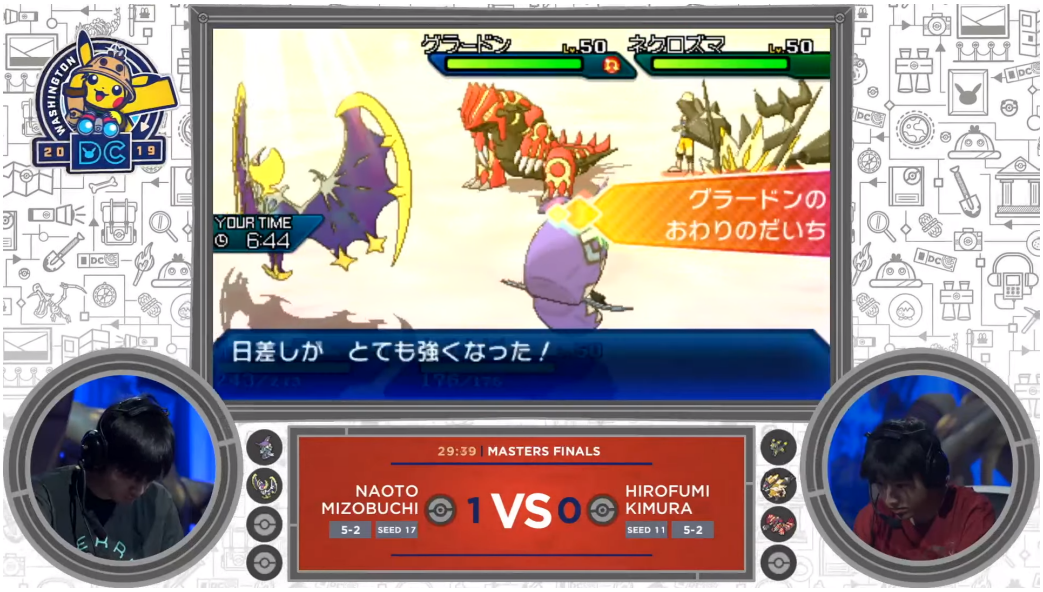

Figure 1.1: Screenshot of the Grand Finals of the Pokemon Video Game Championships 2019 held in Washinton D.C.

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3.2 Location-based AR's effect on users' motivation of a place

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Bibliography

[1] D. Silver, A. Huang, C. J. Maddison, A. Guez, L. Sifre, G. van den Driessche, J. Schrittwieser, I. Antonoglou, V. Panneershelvam, M. Lanctot, S. Dieleman, D. Grewe, J. Nham, N. Kalchbrenner, I. Sutskever, T. Lillicrap, M. Leach, K. Kavukcuoglu, T. Graepel, and D. Hassabis, "Mastering the game of go with deep neural networks and tree search," *Nature*, vol. 529, pp. 484–503, 2016. [Online]. Available: `http://www.nature.com/nature/journal/v529/n7587/full/nature16961.html`.

APPENDIX A - Machine Specs

Table 6.1: Machine specs

Item	Value
CPU	Intel Xeon E5-2690
Memory	188G
OS	18.04.5 LTS (GNU/Linux 4.15.0-121-generic x86_64)

APPENDIX B - Derivation of the simplest form of policy gradient

Derivation of the simplest form of policy gradient is provided below.

$$\begin{aligned}
\nabla_\theta J(\pi_\theta) &= \nabla_\theta \, \mathbb{E}_{\tau\sim\pi}[R(\tau)] \\
&= \nabla_\theta \int_\tau P(\tau|\theta)R(\tau) \\
&= \int_\tau \nabla_\theta P(\tau|\theta)R(\tau) \\
&= \int_\tau P(\tau|\theta)\nabla_\theta log P(\tau|\theta)R(\tau) \\
&= \mathbb{E}_{\tau\sim\pi}[\nabla_\theta log P(\tau|\theta)R(\tau)] \\
&= \mathbb{E}_{\tau\sim\pi}[\nabla_\theta log \pi_\theta(a_t|s_t)R(\tau)]
\end{aligned}$$

This is a expectation, which can be estimated with a sample mean. Denote the estimated policy gradient as $\hat{g}$:

$$\hat{g} = \frac{1}{D}\sum_{\tau\in D}\sum_{t=0}^{T}\nabla_\theta log \pi_\theta(a_t|s_t)R(\tau)$$