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Expertise

- Python
  - Pytorch
  - Matplotlib
  - OpenCV
- C# & Unity

Language

Japanese

English

Reference

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About Me

I am a master student in National Chengchi University, and I'm interesting in Computer Vision, Computer Graphics, Image Processing and Machine Learning.

Education

National Chengchi University — Taipei, Taiwan
M.S. in Computer Science and Information Enginnering — 2021-Present
GPA 4.21 / 4.3

National Chengchi University — Taipei, Taiwan
B.S. in Computer Science (Minor in Mathematical Sciences) — 2017-2021
GPA 3.78 / 4.3

Experience

National Chengchi University — Taipei, Taiwan
Teaching Assistant in Image Processing — 2023

Chunghwa Telecom — Taipei, Taiwan
Lecturer in Machine Learning and Deep Learning — 2022

National Chengchi University — Taipei, Taiwan
Teaching Assistant in Deep Learning: Fudamentals and Application — 2022

National Chengchi University — Taipei, Taiwan
Teaching Assistant in Computer Organization and Architecture — 2021

ChinaTrust Commercial Bank (CTBC) — Taipei, Taiwan
Intern in Information Technology Department — 2021

National Chengchi University — Taipei, Taiwan
Teaching Assistant in Object Orientation Programming — 2020

BQool Inc. — Taipei, Taiwan
Intern in Artificial Intelligence Department — 2019

Conference Papers

ICASSP 2023, Greece

- Y.-T. Peng, **W.-H. Li**, 2023.06, **"Rain2Avoid: Self-Supervised Single Image Deraining"** presented in 2023 IEEE International Conference on Acoustics, Speech and Signal Processing. (ICASSP 2023)

CGW 2021, Keelung

- **W.-H. Li**, T.-Y. Li, 2021.06, **"Using Non-player Character's Motion Adjustment and Camera Planning to Enhance Interactive Storytelling Experience,"** presented in 2021 Computer Graphics Workshop.

Honors & Awards

AICUP 2022, Taipei, Taiwan

- **Ministry of Education Artificial Intelligence Cup Award.**
- Top 10% in the competition on The Counting Competition of Drones **[19/236; ~8%]**

AICUP 2021, Taipei, Taiwan

- **Ministry of Education Artificial Intelligence Cup Award.**
- A Third place award in the competition on Traditional Chinese Scene Text Recognition **[3/ 123; ~2.4%]**

Presidential Award 2021, Taipei,Taiwan

- **Department of Computer Science, National Chengchi University**
  - A 3rd place and 1st place

111年度資訊學院研究生成績優異獎審核結果表

（一）110學年第1學期共4名

單位	組別	年級	學號	學生姓名	修正後金額
資科系	智慧計算組	二	110753201	曾昱維	15,000
資科系	智慧計算組	二	110753207	林依樺	12,000
資科系	資工組	二	110753106	李偉華	9,000
資科系	資工組	二	110753113	張皓博	6,000

（二）110學年第2學期共4名

單位	組別	年級	學號	學生姓名	修正後金額
資科系	資工組	二	110753106	李偉華	15,000
資科系	資工組	二	110753117	莊崴宇	12,000
資科系	資工組	二	111753106	彭怡靜	9,000
資科系	智慧計算組	二	110753208	蔣明憲	6,000

Conference Papers Offprint

ICASSP 2023, Greece

- Y.-T. Peng, **W.-H. Li**, 2023.06, **"Rain2Avoid: Self-Supervised Single Image Deraining"** presented in 2023 IEEE International Conference on Acoustics, Speech and Signal Processing. (ICASSP)

RAIN2AVOID: SELF-SUPERVISED SINGLE IMAGE DERAINING

Yan-Tsung Peng and Wei-Hua Li

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Department of Computer Science, Taipei, Taiwan

ABSTRACT

The single image deraining task aims to remove rain from a single image, attracting much attention in the field. Recent research on this topic primarily focuses on discriminative deep learning methods, which train models on rainy images with their clean counterparts. However, collecting such paired images for training takes much work. Thus, we present Rain2Avoid (R2A), a training scheme that requires only rainy images for image deraining. We propose a locally dominant gradient prior to reveal possible rain streaks and overlook those rain pixels while training with the input rainy image directly. Understandably, R2A may not perform as well as deraining methods that supervise their models with rain-free ground truth. However, R2A favors when training image pairs are unavailable and can self-supervise only one rainy image for deraining. Experimental results show that the proposed method performs favorably against state-of-the-art few-shot deraining and self-supervised denoising methods.

Index Terms— Image deraining, self-supervised, stochastic derained references

1. INTRODUCTION

Images taken with noise or negative interferences, such as haze, mist, or rain, would cause performance drops for outdoor computer-vision applications with object detection and recognition. It is essential to process those images to restore their clean background. Image deraining is the task of removing rain from a rainy image to obtain a clean background.

Past conventional methods usually approached image deraining by decomposing a rainy image into rain streaks and clean background, which proposed to capture rain streaks based on image prior [1], statistical dictionary learning [2], sparse coding [3, 4], low-rank approximation [5], and Gaussian mixture models [1]. However, these methods do not work well on images with complex and varying rain scenes since they may not generalize sufficiently for these changing scenes with only a statistical model based on a priori assumptions.

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Deep-learning-based approaches have recently achieved great success in low-level vision tasks. For image deraining, training deep-learning-based models with a large amount of data can help generalize various scenes and obtain promising restoration results. In deraining, most current learning-based methods are fully supervised [6–8]. However, fully supervised methods require numerous rainy and rain-free training image pairs for models to learn. Still, it is challenging to obtain real-world rainy images and their clean counterparts. Besides, a domain gap may exist between the training and test set, deteriorating model performance. To address this issue, one can use unpaired rainy and rain-free images to train deraining models [9, 10] based on CycleGAN. Nevertheless, these unsupervised generative adversarial approaches may introduce unwanted artifacts to restoration results.

Little work has been done in image deraining with a self-supervised learning model, meaning training the model supervised with only the input image itself. If we consider image deraining as an image denoising task, there have been several important works proposed in self-supervised image denoising, such as Noise2Void (N2V) [11], and Noise2Self (N2S) [12]. They assume neighboring pixels in an image are probabilistically dependent but conditionally independent from noise given different pixels. Hence, theoretically, one can estimate any pixel using its neighboring pixels since the mean of noise is assumed to be zero. However, these methods do not work for deraining due to the expected value of rain pixels should not be zero, violating the assumption.

Inspired by N2V [11], this paper proposes Rain2Avoid (R2A), a novel self-supervised training scheme that requires only rainy images for image deraining. We exploit a locally dominant gradient as a priori information to reveal possible rain streaks and avoid those rain pixels upon training with the input rainy image. R2A favors when rain-free images are unavailable since it can self-supervise only rainy images for deraining. Our primary contributions are two-fold. First, to the best of our knowledge, this study is one of the first attempts at self-supervised image deraining. Second, R2A integrates a conventional image gradient prior to extract rain pixels and the proposed self-supervised training scheme to perform favorably against state-of-the-art (SOTA) few-shot deraining and self-supervised denoising methods.

CGW 2021, Keelung

- **W.-H. Li**, T.-Y. Li, 2021.06, **"Using Non-player Character's Motion Adjustment and Camera Planning to Enhance Interactive Storytelling Experience,"** presented in 2021 Computer Graphics Workshop.

Presented in 2021 Computer Graphics Workshop, 2021.

以角色動作調整與攝影機路徑規劃提升互動敘事體驗

Using Non-player Character's Motion Adjustment and Camera Planning to Enhance Interactive Storytelling Experience

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ABSTRACT

近年來，互動數位敘事(Interactive Digital Storytelling，IDS)在遊戲或是影視產業都有廣泛的應用。在互動敘事的系統中，故事設計者可以根據使用者對於故事的回饋，選擇性地給予使用者不同的感受或是不同的劇情走向。然而現今遊戲在兼顧互動性及沉浸感的營造，仍然有進步的空間，特別是在述說故事的攝影機擺設上，多缺乏彈性的規劃。本研究旨在開發一款互動敘事遊戲，能透過使用者的回饋，規劃攝影機路徑，以述說該情境下的故事，並在 Run-time 時調整非玩家角色(Non-Player Character， NPC)的對話，營造出不同的場景氛圍及細節。我們設計了實驗及問卷，根據使用者的回饋來探討此技術的成效，提出結論及未來發展的建議。

CCS Concepts

I.3.7 [Three-Dimensional Graphics and Realism]: Animations

Keywords

Character Animation, Game Design, Interactive Storytelling

1. 簡介

在第三人稱的遊戲中，遊戲的非玩家角色(Non-Player Character， NPC)以及攝影機的規劃，對遊戲體驗有相當大的影響，兩者皆是扮演著「故事敘述者」的角色，非玩家角色會與玩家有直接的互動，對話的內容會影響到玩家的情緒以及獲得的資訊量。攝影機的擺放則會影響到畫面構圖，在視覺上渲染出不同的場景氣氛，也能透過能見度的調整，影響到玩家獲取資訊量的多寡。

在過去，第三人稱遊戲中攝影機擺放的方式主要是預先在環境中擺放數台攝影機，等待玩家走進特定區域，觸發攝影機的切換。然而這種方法相當的耗費設計者的人力成本與時間成本。因此近年來，有學者提出了自動擺放攝影機的技術以及動態切換攝影機的技術，目的是希望能降低人力成本，也希望能在遊戲進行時，動態評估玩家周遭環境給予玩家適當的畫面。而本研究旨在利用這兩項技術，加強攝影機與互動敘事遊戲的契合度，紀錄玩家在遊戲中的表現以及和非玩家角色的互動狀況，給予不同的攝影機安排，突顯互動敘事的遊戲特質。

為進行本研究，我們開發了一款第三人稱互動敘事解謎遊戲，使本研究有一個可實作的平台。在此平台中，我們將遊戲分為探索模式(Navigation Mode)以及敘事模式(Storytelling Mode)兩種，在探索模式時玩家可以在遊戲場景中隨意探索與場景中的遊戲物件進行互動，也可與非玩家角色進行對話，獲得解謎的線索。而在敘事模式中，玩家會觀賞遊戲動畫，以及玩家和非玩家角色的對話內容，也需要在這個模式中針對非玩家角色提出的問題做出回應。藉由這樣的互動傳達設計者想要提供的資訊，也讓遊戲系統能獲取玩家的即時狀態。

在對話產生的技術上，非玩家角色的動作表現以及對話是採用規則設定(Rule-Based)的方式，根據玩家的反應以及遊戲設計者的劇情安排，讓非玩家角色產生不同的對話內容。在攝影機的部分，則是分成前處理以及動態規劃過程兩個部分，前處理是參考 Alberto Jovane 使用的 Raycasting 技術[5]進行環境中的多台攝影機擺放，而動態規劃的部分則是使用動態評分的機制，即時替預先擺放好的每一台攝影機評分，考量攝影機的眾多條件，合成每一台攝影機的分數，接著再根據分數的比較進行攝影機的切換。

最後，我們透過實驗設計，針對沒有進行調整技術的控制組及加入動態調整技術的實驗組，邀請受試者進行比較與分析。

2. 相關研究

由於本計畫研究的方向以「互動敘事」和「攝影機自動規劃」為主，因此我們就這兩個主題探討國內外的相關論文，了解目前相關研究的情況並探討是否仍有可以延伸的地方。

2.1 互動敘事

過去的互動敘事產生的研究主要分為兩種機制：分支(Branching)和規劃(Planning)。而在[1]中，Cavazza 等人以參與遊戲角色為主，藉由互動對角色做出規劃，影響遊戲角色後續之行為，創造具有戲劇化的劇情，並導致不同的故事結局。然而在 Cavazza 等人之研究中，並未見有針對遊戲角色的動作做出鏡頭的調整，例如為避免大幅度的動作使角色離開鏡頭，應將鏡頭擺放位置較遠。甚至有些角色與角色之間的互動情形，也是需要動態的調整鏡頭，以凸顯故事敘說者欲擺放之重點，讓遊戲玩家可以更加沉浸於故事當中。