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Jeongwhan Choi

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Introduction

I am a Ph.D. candidate advised by Noseong Park in the Dep. of *Artificial Intelligence* at Yonsei University. I have a broad interest in graph neural networks, recommender systems, spatio-temporal forecasting, and differential equations. Recently, I have been working on developing graph-based deep learning methods inspired by differential equations in natural science.
I was an undergrad at Jeonbuk National University (2016-2020), majoring in *software engineering*. I was privileged to be advised by Suntae Kim and Duksan Ryu.

Research Interest

- Artificial Intelligence
  - Graph Neural Networks
  - Recommendation (Collaborative Filtering and Sequential Recommendation)
  - Spatiotemporal Forecasting
  - Differential Equation-based Deep Learning
- Software Engineering
  - Software Defect Prediction
  - AI-based Software Analytics

Research Experience

Integrated Ph.D. Student *Aug 2020 - Now*
Big Data Analytics Laboratory (BigDyL), Yonsei University (Advisor: Prof. Noseong Park)
Undergraduate Student Research Assistant *Jan 2020 - Aug 2020*
AI & SE Lab, Jeonbuk National University (Advisor: Prof. Duksan Ryu)
Undergraduate Student Research Assistant *Nov 2018 - Nov 2019*
Software System and Engineering Laboratory (SSEL), Jeonbuk National University (Advisor: Prof. Suntae Kim)

Educational Background

Integrated Ph.D., Artificial Intelligence *Sep 2020 - Now*
Yonsei University, Seoul, Republic of Korea
Bachelor, Software Engineering *Mar 2016 - Aug 2020*
Jeonbuk National University, Jeonju, Jeollabuk Do, Republic of Korea

- *magna cum laude* (GPA: 3.98/4.50)

Publication

Jeongwhan Choi and Noseong Park, "Graph Neural Rough Differential Equations for Traffic Forecasting," *ACM Transactions on Intelligent Systems and Technology* (*TIST*), 2023. [paper][IF=10.489]

Jeongwhan Choi, Seoyoung Hong, Noseong Park and Sung-Bae Cho, "GREAD: Graph Reaction-Diffusion Networks," *In Proceedings of the 40th International Conference on Machine Learning* (*ICML*), 2023. [paper][code][Paper Acceptance rate: 27.94% (1,827/6,538)]

Jeongwhan Choi, Seoyoung Hong, Noseong Park and Sung-Bae Cho, "Blurring-Sharpening Process Models for Collaborative Filtering," *Proceedings of the 46th ACM Conference on Research and Development in Information Retrieval* (*SIGIR*), 2023. [paper][code][Paper Acceptance rate: 20.1% (165/822)]

Jeongwhan Choi and Duksan Ryu, "Graph Convolution-based Collaborative Filtering for Web Service QoS Ranking", In *Proceedings of the 25th Korea Conference on Software Engineering* (*KCSE 2023*), 2023, pp. 58-67.

Hwangyong Choi, **Jeongwhan Choi**, Jeehyun Hwang, Kookjin Lee, Dongeun Lee and Noseong Park, "Climate Modeling with Neural Advection-Diffusion Equation," *Knowledge and Information Systems*, Jan. 2023. [paper] [IF=3.205(2021) Five year impact factor]

Jaehoon Lee, Chan Kim, Gyumin Lee, Haksoo Lim, **Jeongwhan Choi**, Kookjin Lee, Dongeun Lee, Sanghyun Hong and Noseong Park, "Time Series Forecasting with Hypernetworks Generating Parameters in Advance," *arXiv preprint arXiv: Arxiv-2211.12034*, 2022. [paper]

Seoyoung Hong, Heejoo Shin, **Jeongwhan Choi**, and Noseong Park, "Prediction-based One-shot Dynamic Parking Pricing," In *Proceedings of the 31st ACM International Conference on Information and Knowledge Management* (*CIKM*), 2022.[paper][code]

Jeongwhan Choi, Hwangyong Choi, Jeehyun Hwang and Noseong Park, "Graph Neural Controlled Differential Equations for Traffic Forecasting," In *AAAI*, 2022. [paper][code][Regular Paper Acceptance rate: 14.2% (1,161/8,198)] [Overall Acceptance rate: 15.2% (1,370/9,020)]

Taeyong Kong, Taeri Kim, Jinsung Jeon, **Jeongwhan Choi**, Yeon-Chang Lee, Noseong Park and Sang-Wook Kim, "Linear, or Non-Linear, That is the Question!," In Proceedings of the 15th ACM International Web Search and Data Mining Conference (WSDM), 2022. [paper][code] [Regular Paper Acceptance rate: 15.8% (80/505)] [Overall Acceptance Rate: 18% (315/1,765)]

Jeongwhan Choi and Duksan Ryu, "Self-Supervised Learning Using Feature Subsets of Software Defect Data", In *Proceedings of the Korea Software Congress* (*KSC*), Dec. 2021, pp.203-205.

Jeehyun Hwang, **Jeongwhan Choi**, Hwangyong Choi, Kookjin Lee, Dongeun Lee and Noseong Park, "Climate Modeling with Neural Diffusion Equations", In *Proceedings of the 21st IEEE International Conference on Data Mining* (*ICDM*), 2021. [paper] [code] [Regular paper acceptance rate: 9.9% (98/990)] [Overall Acceptance Rate: 20% (198/990)]

Jeongwhan Choi and Duksan Ryu, "Bayesian Optimization Framework for Improved Cross-Version Defect Prediction", *KIPS Transactions on Software and Data Engineering* (*KTSDE*), Vol. 10, No. 9, pp. 339-348, Sep. 2021.

Jeongwhan Choi, Jinsung Jeon, and Noseong Park, "LT-OCF: Learnable-Time ODE-based Collaborative Filtering", In *Proceedings of the 30th ACM International Conference on Information and Knowledge Management* (*CIKM*), 2021. [paper] [code] [Regular paper acceptance rate: 21.7% (271/1,251)] [Overall Acceptance rate: 22% (1,101/4,989)]

Jeongwhan Choi and Duksan Ryu, "Bayesian Optimization Framework for Cross-Version Defect Prediction", In *Proceedings of the 23rd Korea Conference on Software Engineering* (*KCSE 2021*), 2021, pp. 63-72. [Best Paper]

Jeongwhan Choi, Jiwon Choi, Duksan Ryu and Suntae Kim, "Improved Prediction for Configuration Bug Report Using Text Mining and Dimensionality Reduction," *Journal of KIISE*, 2021, Vol. 48, No. 1, pp. 35-42.

Jeongwhan Choi and Duksan Ryu, "A Study on the Applicability of Transfer Learning Techniques for Cross-Project Defect Regression," In *Proceedings of the Korea Software Congress* (*KSC*), 2020, pp. 150 - 152.

Jeongwhan Choi, Duksan Ryu, and Suntae Kim, "Comparative Study of Transfer Learning Models for Cross-Project Automotive Software Defect Prediction," In *Proceedings of the Korea Computer Congress* (*KCC*), 2020, pp. 257–259.

Jeongwhan Choi, Jiwon Choi, Duksan Ryu, and Suntae Kim, "Prediction for Configuration Bug Report Using Text Mining," In *Proceedings of the 22nd Korea Conference on Software Engineering* (*KCSE 2020*), 2020, pp. 350–357.

Jeongwhan Choi, Jiwoo Noh, and Suntae Kim, "Prediction Techniques for Difficulty Level of Hanja Using Multiple Linear Regression," *J. Inst. Internet, Broadcast. Commun.*, vol. 19, no. 6, 2019.

Seounghan Song, **Jeongwhan Choi**, Mingu Kang, and Cheoljung Yoo, "A Software Module That Analyzes the Relationship Between Headline and Content of the Web Article: CHIMERA," in *Proceedings of the 2019 KIIT DCS Summer Conference*, 2019, vol. 14, pp. 437–440.

Jeongwhan Choi, "Iceberg-Ship Classification in SAR Images Using Convolutional Neural Network with Transfer Learning," *J. Internet Comput. Serv.*, vol. 19, no. 4, pp. 35–44, 2018.

Awards & Scholarships

Innovation Award, Yonsei University (Best paper in Dept. of Artificial Intelligence) [link] *Jul 2022*

Best Paper Awards in the 23rd Korea Conference on Software Engineering (KCSE 2021) *Feb 2021*

Best Paper Awards in Dep. of Software Engineering *Dec 2019*

Best Paper Awards, Korean Institute of Information Technology *Jun 2019*

The National Scholarship for Science and Engineering, KOSAF(Korea Student Aid Foundation) *2018-2019*

- This scholarship supports undergraduates with strong academic performance in science and engineering, with the purpose of developing future leaders in those fields.

Academic Excellent Scholarship *2016-2019*

Talks

Talk on 1st Seminar held by Graph User Group (GUG) *Jun 2023*

Invited talk on Top-conference session, Korea Computer Congress (KCC 2023) [slides] *Jun 2023*

Talk on 2023 KSIAM AI Winter School, held by Korean Society for Industrial and Applied Mathematics (KSIAM)[slides][website] *Feb 2023*

Talk on 1st Workshop on AI held by Yonsei Univ. [slides][poster] *Oct 2022*

Poster presentation for AIGS Symposium 2022 held at the COEX Grand Ballroom [poster] *Aug 2022*

Invited talk on Top-conference session, Korea Computer Congress (KCC 2022) [slides] *Jul 2022*

Tutorial on Korea Artificial Intelligence Association (KAIA) *Nov 2021*

- Topic: "Graph-based Collaborative Filtering and Neural ODEs"
- This talk is part of a tutorial called "Deep Learning Inspired by Differential Equation" [slides].

Service

- Reviewer in SDM 2024
- Reviewer in AAAI 2023
- Reviewer in Applied Artificial Intelligence
- Reviewer in KDD 2023
- Reviewer in Learning on Graph Conference (LoG) 2022, 2023
- Reviewer in IEEE Transactions on Intelligent Transportation Systems
- Reviewer in ICDM 2021, 2022

Patent and S/W Program

[Issued Patent] Apparatus and Method for Processing Spatiotemporal Data Based on Graph Neural Controlled Differential Equations, Noseong Park, **Jeongwhan Choi**, Jeehyun Hwang, Hwangyong Choi, U.S.A. Patent(Issued Number: 18/085,109). 2022.12.20 *Dec 2022*

[Issued Patent] Apparatus and Method for Processing Spatiotemporal Data Based on Graph Neural Controlled Differential Equations, Noseong Park, **Jeongwhan Choi**, Jeehyun Hwang, Hwangyong Choi, Domestic Patent(Issued Number: 10-2022-0151819). 2022.11.14 *Nov 2022*

[S/W] LT-OCF: Learnable-Time ODE-based Collaborative Filtering, Korea Copyright Commission, C-2021-052779, 2021.12. *Dec 2021*

[Issued Patent] Apparatus and Method for Collaborative Filtering Based on Learnable-Time Ordinary Differential Equation, Noseong Park, **Jeongwhan Choi**, Jinsung Jeon, Japan Patent(Issued Number: 2021-215162). 2021.12.28 *Dec 2021*

[Issued Patent] Apparatus and Method for Collaborative Filtering Based on Learnable-Time Ordinary Differential Equation, Noseong Park, **Jeongwhan Choi**, Jinsung Jeon, U.S.A. Patent(Issued Number: 17/563,726). 2021.12.28 *Dec 2021*

[Issued Patent] Apparatus and Method for Collaborative Filtering Based on Learnable-Time Ordinary Differential Equation, Noseong Park, **Jeongwhan Choi**, Jinsung Jeon, Domestic Patent(Issued Number: 10-2021-0177928). 2021.12.13 *Dec 2021*

[Granted Patent] Apparatus and Method for Measuring Difficulty Level of Chinese Character Using Regression Analysis, Suntae Kim, **Jeongwhan Choi**, Jiwoo Noh, Domestic Patent(Application Number:10-2019-0141339). 2019.11. [link] *Nov 2019*

Certifications

University Machine Learning Camp in Jeju, *Jeju University* *Aug 2020*

- See credential

IBM Blockchain Foundation for Developers , *Coursera* *Feb 2018 - Present*

- License 5MMQUBFWE2K3 (See credential)

Machine Learning Engineer Nanodegree, *Udacity* *Jan 2018 - Present*

- See credential

Machine Learning, *Coursera* *July 2017 - Present*

- License EEYYGQPCFLN7 (See credential)

Skills

Tools & Technologies,

- PyTorch, TensorFlow, Python
- Java, C/C++, R, LaTeX, VBA, Unified Modeling Language
- Android, Matlab, Git, RSA
- MySQL, Tomcat, JSP, HTML, Javascript, JUnit

Industry Knowledge,

- Artificial Intelligence, Graph Neural Networks, Neural Ordinary Differential Equations (Neural ODEs), Recommender Systems, Time-series Forecasting, Spatio-temporal Forecasting, Software Defect Prediction

- Software Engineering, Object Oriented Programming, Design Pattern, Compiler, Software Testing(Static Analysis)
- Text Mining, Image Processing for SAR Image
- ARM Cortex-M3, ESP-8266

Projects (From 2017 to 2019)

Prediction for Configuration Bug Report Using Text Mining *Nov 2019 - Dec 2019*

- The purpose of this project is to predict the configuration bug reports using machine learning techniques and NLP.

Development of capability assessment evaluation algorithm for personalized self-study with Hanja-Chinese parallel *Dec 2018 - Expected Nov 2019*

- The purpose of this project is to solve the problems of existing Hanja character difficulty selection method.
- It includes the technique for measuring the difficulty of Hanja characters using artificial intelligence.
- It also covers personalized learning induction technique using a clustering model.

Stock Price Prediction Model Based LSTM to Maximize Return on Investment *Oct 2018 - Dec 2018*

- The purpose of this project is to predict the long-term stock flow based on the AI prediction model and to derive meaningful ROI.
- This project has a paper which is not submitted.
- See project

Advanced Lane Finding Project *Jul 2018*

- The goal is to find the lane line using advanced image processing techniques.
- See project

Vehicle Detection *Jul 2018*

- The software pipeline using computer vision algorithms to detect vehicles in videos.
- See project

Clone Driving Behavior *Jun 2018*

- The goal is to clone driving behavior via the CNN model.
- See project

Recipe Assistant App *Apr 2018 - Jun 2018*

- The recipe assistant app which helps people to cook an easy way. This app was implemented by Android and improved by several design patterns.
- See project

Tic-Tac-Toe game for LPC 1768 *Jun 2018*

- This project is the Tic-Tac-Toe Game using ARM Cortex-M3(LPC 1768)
- See project

Lane Finding Project *Mar 2018*

- The goal is to find the lane lines on the road.
- See project

Iceberg Classifier *Jan 2018*

- The goal is to create an image classification model that finds icebergs among SAR images collected by satellites. This project has a paper published in JICS.
- See project

Helicopter Battle Game *Apr 2017 - Jul 2017*

- This Java project includes the software engineering knowledges such as objective-oriented design, design patterns and so on.
- See project

Smart Mailbox *Sep 2017 - Dec 2017*

- The smart mailbox project played a role in helping people who forget offline mails through notifications to mobile phones.
- See project