JONGWON LIM

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Research Interests

High Energy Physics Experiment, Top & Higgs Physics, Tau Lepton, Machine Learning

Education

Mar.2020 - Aug.2022
Seoul, Republic of Korea

Master of Science in Physics, Hanyang University
- Advisor: Prof. Tae Jeong Kim
- Dissertation: "Search for charged lepton flavor violation in top quark sector with hadronic tau final state using CMS Run 2 data at $\sqrt{s}$ = 13 TeV" [pdf]
- Honored with a Best Dissertation Award.

Mar.2016 – Feb.2020
Seoul, Republic of Korea

Bachelor of Science in Physics, Hanyang University
- Dual degree: Bachelor of Science in Mechanical Engineering
- Advisor: Prof. Tae Jeong Kim
- Bachelor's Thesis: "Study of identification of b-jets in the $t\bar{t}b\bar{b}$ using Deep Neural Networks"

Research Experience

Jan.2020 - Aug.2022
Genève, Switzerland

Search for the charged lepton flavour violation (cLFV) in the top quark sector using CMS Run2 data
CMS Collaboration, CERN
Team Leader: Prof. Tae Jeong Kim
- Led the analysis with generating simulation samples for the cLFV events adopting the Standard Model effective field theory (SMEFT) model.
- Analyzed the CMS Run2 data using ROOT, C++, and Python by comparing with simulated data using GEANT4.
- Applied deep neural network algorithms to identify rare cLFV signal events from the SM backgrounds using kinematic variables from top quark reconstruction for the cLFV and SM interactions.
- Set upper limits of cross section and branching fractions of the EFT operators for the cLFV interaction in 5σ confidence level with systematic and uncertainty studies.

Feb.2020 - Jul.2022
Seoul, Republic of Korea

Learning to increase matching efficiency in identifying additional b-jets in $t\bar{t}b\bar{b}$ process
Elementary Particle Physics Laboratory, Hanyang University
Advisor: Prof. Tae Jeong Kim
- Interdisciplinary study with the Department of Computer Science
- Contributed with generating more than 10M events of $t\bar{t}b\bar{b}$ and $t\bar{t}H(b\bar{b})$ simulated samples in a Monte-Carlo method using MadGraph, MadSpin, Pythia, and Delphes.
- Improved DNN performance for identifying b-jets by optimizing loss function of each nodes, proposing better identification of $t\bar{t}b\bar{b}$ events.

Mar.2019 - Nov.2020
Seoul, Republic of Korea

Identification of additional jets in the $t\bar{t}b\bar{b}$ events by using DNN
Elementary Particle Physics Laboratory, Hanyang University
Advisor: Prof. Tae Jeong Kim

- Initially participated as an undergraduate researcher, learning basic particle properties and data visualization using ROOT for data analysis.
- Learned how to produce simulated events using MadGraph and Delphes and conducted data analysis using C++.
- Improved DNN performance for identification of additional jets by changing nodes and layers of network.

Feb.2020
Seoul, Republic of Korea

The Second MadAnalysis5 workshop on LHC recasting @ Korea
Korea Institute for Advanced Science (KIAS)
Advisor: Prof. Benjamin Fuks, *Sorbonne University, France*

- Team project "Staus in the di-tau plus missing transverse energy channel."
- Learned both theories and experimental view of particle physics.
- Studied tau lepton properties by recasting published analysis using MadAnalysis and simulation samples.

Sept.2019 - Dec.2019
Seoul, Republic of Korea

Design of Collision Warning and Breaking Algorithm using Region-based Convolutional Neural Networks (RCNN)
Parallel Computing Laboratory, Hanyang University
Advisor: Prof. Sang Hwan Lee

- Participated in Mechanical Engineering graduate project for dual degree.
- Led a team project and developed algorithms for real-time object detection with RCNN applicable to two-wheeled robots for practical implementation.
- Won second place in the Mechanical Engineering Design presentation.

Work Experience

Sept.2022 - Jun.2024
Seoul, Republic of Korea

Seoul Metropolitan Fire & Disaster Headquarters

- Completed 3 weeks of basic military training at Korea Army Training Center.
- Served 21 months at Seoul Civil Disaster Experience Center as a social service personnel for Korea military service obligation.
- Learned to cope with emergency situations and help social minorities with embracing diversity and equity.

Publications

[1] CMS Collaboration, "Search for charged-lepton flavour violation in top quark interactions with an up-type quark, a muon, and a τ lepton in proton-proton collisions at $\sqrt{s}$ = 13 TeV," *Accepted for publication in Journal of High Energy Physics*, Apr. 2025. arXiv: 2504.08532 [hep-ex]. [Online]. Available: https://cms-results.web.cern.ch/cms-results/public-results/publications/TOP-22-011/index.html.

[2] C. Jang, S. K. Ko, J. Choi, **J. Lim**, Y. K. Noh, and T. J. Kim, "Learning to increase matching efficiency in identifying additional b-jets in the $t\bar{t}b\bar{b}$ process," *The European Physical Journal Plus*, Jul. 2022. DOI: 10.1140/epjp/s13360-022-03024-8.

[3] **J. Lim**, C. T. Lu, J. H. Park, and J. Park, "Implementation of the ATLAS-SUSY-2018-04 analysis in the MadAnalysis 5 framework (staus in the di-tau plus missing transverse energy channel; 139 $fb^{-}1$)," *Modern physics letters A*, Jan. 2021. DOI: 10.1142/s0217732321410091.

[4] J. Choi, T. J. Kim, **J. Lim**, J. Park, Y. Ryou, J. Song, and S. Yun, "Identification of additional jets in the $t\bar{t}b\bar{b}$ events by using deep neural network," *Journal of the Korean Physical Society*, Nov. 2020. DOI: 10.3938/jkps.77.1100.

Conferences

[1] **J. Lim***, and T.-J. Kim, Search for Charged Lepton Flavour Violation in top quark interaction with muon and tau in pp collisions at $\sqrt{s}$ = 13 TeV. *2022 KPS Spring Meeting: Korean Physics Society*,Apr. 2022. Poster session

[2] J. Choi, S.-Y. Choi, T.-J. Kim, **J. Lim***, J. Song, Y. Ryou, and S. Yun, Search for LFV in top quark sector with charm, muon, and tau final states. *2020 KPS Fall Meeting: Korean Physics Society*, Nov. 2020. Oral session

* Presenter at a conference

Scholarships & Awards

Aug.2022
Hanyang University
The Best Dissertation Award, Dean of Graduate School
Selected based on outstanding publications and conference presentations as well as master's dissertation and defense.

Mar.2020 - Dec.2021
Hanyang University
Graduate Program Scholarship
This scholarship covered tuition payments for 4 academic semesters.

Mar.2020
Hanyang University
Han Ki-su Scholarship, Department of Physics
Awarded to outstanding undergraduate physics graduates pursuing graduate studies.

Feb.2020
Hanyang University
Academic Honor Award, College of Natural Science
Graduated bachelor's degree with GPA above 3.75/4.5; Cum Laude

Dec.2019
Hanyang University
The 11th Capstone Design Fair, LINC
Topic: "Design of Collision Warning and Breaking Algorithm using RCNN."

Dec.2019
Hanyang University
Mechanical Engineering Design Project Presentation, 2nd Place
Topic: "Design of Collision Warning and Breaking Algorithm using RCNN."

Dec.2019
Hanyang University
Natural Science Academic Conference, 2nd Place
Topic: "Identification of additional jets in the $t\bar{t}b\bar{b}$ events using Neural Network."

Sept.2017
Hanyang University
Hanyang Brain Scholarship, 3rd Place at Department of Physics
Academic excellence scholarship (30% tuition reduction)

Sept.2017
Hanyang University
Learning Mate Program, 2nd Place
Improved understanding of Modern Physics lectures through team-based learning.

Teaching Experience

Mar.2020 - Dec.2021
Seoul, Republic of Korea
General Physics and Experiment 1 and **2**
- Taught concepts of general physics and experiments in undergraduate level for four semesters.
- Total 9 physics experiments were taught per semester and homework sets were graded weekly with Q&A.

Professional Membership

Jan.2020 - Aug.2022
Genève, Switzerland

CERN, USER
- Tau Data Quality Monitoring (DQM) graphical user interface development for experimental physics responsibilities (EPR 1 month).
- Made 4 presentations at Tau particle object group (POG).
- Weekly Top mass and properties physics group meeting.
- Access to CERN computing resources and collision data, and offline visit.

Schools

Sept.2021
Virtual, CERN

CMS Data Analysis School
- Basic introduction of high energy physics experiment at the CMS experiment.
- Participated in hands-on session “Search for an excited b quark decaying to a top quark and a W-boson." and made a short presentation.

Dec.2018
Yangpyeong, Rep. of Korea

Winter Camp on Particle Physics, Korea Institute for Advanced Study (KIAS)
- Took lectures about introduction to the Standard Model, cosmology, phenomenology on particle detector and future particle accelerator.
- Participated in team-based learning sessions for ROOT and MadGraph.

Oct.2018
Seoul, Republic of Korea

Fundamentals of Deep Learning for Computer Vision, NVIDIA
- Learned basic visual object identification using CUDA and convolutional neural network (CNN) algorithms.

Skills

- Particle data analysis on Linux using **ROOT, C, C++**, and **Python**.
- Machine learning using **Keras, Tensorflow** and **PyTorch**.
- **Parallel computing** and **cloud computing** for data analysis.
- Collaboration with Git and documentation using **Tex**.
- Production of simulation events using **MadGraph, MadSpin, Pythia**, and **Delphes**.
- Fluent in speaking and writing in **English**, IELTS 7.5 (test taken Feb. 03 2024)

Extracurricular Activities

Mar.2016 - Feb.2020
Hanyang University

Inertia, Computer club, Department of Physics
Team-based learning for programming languages - Python, C, C++

Mar.2016 - Feb.2020
Hanyang University

$\hbar$-action, Academic Physics club, Department of physics
Academic presentation: Introduction to Fluid Dynamics (2019)

Mar.2017 - Feb.2020
Hanyang University

2nd Violin, **Hanaklang**, Hanyang Amateur Orchestra
Participated in weekly orchestra rehearsal.

Sept.2016 - Dec.2016
Seoul, Republic of Korea

Volunteer at Children’s Museum of National Folk Museum (30 hours)
Ensured safety for children and managed museum facilities.

References

Dr. Tae Jeong KIM
Supervisor of master degree
Professor, Department of Physics, Hanyang University
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Dr. Su Yong CHOI
Research collaborator at the CMS
Professor, Department of Physics, Korea University
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