Minuk Ma

Contact
MOBILE:+1 778 712 2396
E-MAIL: minukma@cs.ubc.ca, minuk.ma@kaist.ac.kr
ADDR: 2111 LowerMall, Vancouver, BC, Canada, V6T 1Z4
BLOG: www.minukma.com

Research Interests

Keywords: Large-scale AI, computational immunology, medical data analysis
Interest: I want to positively influence people's lives with my knowledge in computer science. I am excited by the great synergy between the AI technology (predictive models and representation learning) and biomedical field (big data).

Education

University of British Columbia (UBC) Vancouver, Canada
Doctor of Philosophy in Computer Science (Advisor: Jiarui Ding) September 2023 —
- Large-scale AI methods for biomedical data analysis
- Analysis of single-cell immune profiles, developing predictive tools

Korea Advanced Institute of Science and Technology (KAIST) Daejeon, Korea
M.S. degree in Electrical Engineering (Advisor: Chang D. Yoo) February 2020
- Researched on multi-modal AI, semantic segmentation, image-to-image translation, meta-learning, crowd counting, reinforcement learning, etc
- Contributed to *seven* publications including *two* CVPRs *and* one ECCV

Korea Advanced Institute of Science and Technology (KAIST) Daejeon, Korea
B.S degree in Electrical Engineering (Advisor: Jun Hyuk Kang)
B.S degree in Computer Science (double major) February 2018

Experience

Lunit Inc. Seoul, Korea
Research scientist, team leader of data-centric AI team March 2020—April 2023
- Developed medical AI models to profile digital pathology images for immunotherapy response prediction, antibody scoring (ex. HER2, PDL1, ER/PR, ..), and mutation prediction. Led data-centric approaches to reduce annotation cost and improve generalization of AI models.

Republic Of Korea Army Training Camp Nonsan, Chungcheongnam-do , Korea
Private May 2022—May 2022
- Completed basic military training course required for all Korean men

Research Project, Samsung Electronics & AIM Lab Daejeon, Korea
Researcher, Multi-Modal Video Question Answering March 2018—February 2020
- Developed multi-modal AI models that combine video and natural language to perform various downstream tasks such as QA and temporal moment localization.

CUOP Program, Ion-Communications Seoul, Korea
Intern, Docker and Kubernates January 2017—March 2017
- Investigated the usage of docker and kubernates frameworks for web server deployment

Exchange Student Program, Tandon School of Engineering NY, US
Student, Department of Computer Science February 2016—June 2016
- In NYU, developed a prototype of social reading platform using python and javascript

Naver D2 Startup Factory Seoul, Korea
Researcher, Development of Smart Electric Skateboard June 2015—August 2015
- Developed electric skateboard that does not require RC controllers with Arduino & pressure sensors (v1) and PCB & capacitive sensors (v2), funded by Naver

Awards and Honorary

LG Electronics Award, IEIE (2019)
KAIST AI WorldCup, 4th Place (2018)
E*5 KAIST Startup Competition, 2nd Place (2015)

Patents

Method and system for training a machine learning model to detect abnormal regions in pathological slide images. KR: 10-2021-0120991 (Application)

Publications in AI conf. / workshop

C. Kang, C. Lee, H. Song, **M. Ma**, S. Pereira, Variability Matters : Evaluating inter-rater variability in histopathology for robust cell detection, European conference on computer vision, workshop on AI-Enabled Medical Image Analysis: Digital Pathology & Radiology/COVID19 (AIMIA) (**ECCVW**), 2022

M. Ma*, S. Yoon, J. Kim, Chang D. Yoo, "VLANet: Video-Language Alignment Network for Weakly-Supervised Video Moment Retrieval, European conference on computer vision, Springer, 156-171 (**ECCV**), 2020

J. Kim, **M. Ma**, T. Pham, K. Kim, Chang D. Yoo, "Modality Shifting Attention Network for Multi-modal Video Question Answering", IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), Seattle, WA, United States, 2020

M. Ma, J. Kim, Chang D. Yoo, "DAFF: Domain-Agnostic Few-Shot Facial Landmark Detector By Learning Batch-Adaptive Spatial Transformer Networks", *The Institute of Electronics and Information Engineers (**IEIE**)*, Jeju, Korea, 2019

J. Kim, **M. Ma**, K. Kim, S. Kim, Chang D. Yoo, "Progressive Attention Memory Network for Movie Story Question Answering", *IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**)*, Long Beach, CA, USA, 2019

J. Kim*, **Minuk Ma***, K. Kim, S. Kim, Chang D. Yoo, "Gaining Extra Supervision via Multi-task learning for Multi-Modal Video Question Answering", *International Joint Conference on Neural Networks (**IJCNN**)*, Budapest, Hungary, 2019

K. Bae, **M. Ma**, H. Jang, M. Ju, H. Park, Chang D. Yoo, "ImaGAN: Unsupervised Training of Conditional Joint CycleGAN for Transferring Style with Core Structures in Content Preserved", *Asian Conference on Computer Vision (**ACCV**)*, Perth, Australia, 2018

M. Ma*, H. Jang, M. Ju, Chang D. Yoo, "Playing Bi-Wheeled Robotic Soccer with Deep Q Learning Based on High-Level Action Modeling", *International Conference on Consumer Electronics (**ICCE-ASIA**)*, Jeju, Korea, 2018

Publications in medical journal / abs.

H. Kim, S. Kim, S. Choi, C. Park, S. Park, S. Pereira, **M. Ma**, D. Yoo, K. Paeng, W. Jung, S. Park, C. Ock, S. Lee, Y. Choi, J. Chung, "Clinical validation of artificial intelligence-powered PD-L1 tumor proportion score interpretation for immune checkpoint inhibitor response prediction in non-small cell lung cancer". *JCO Precision Oncology.* 2024 May.

K. Lee, E. Choi, S. Cho, S. Park, J. Ryu, A. V. Puche, **M. Ma**, J. Park, W. Jung, J. Ro, S. Kim, G. Park, S. Song, C. Ock, G. Choe, J. Park, "An artificial intelligence-powered PD-L1 combined positive score (CPS) analyser in urothelial carcinoma alleviating interobserver and intersite variability". *Histopathology.* 2024 May.

D. Kim, Y. Lim, C. Ock, G. Park, S. Park, H. Song, **M. Ma**, M. Mostafavi, E. Kang, M. Ahn, K. Lee, J. Kwon, Y. Yang, Y. Choi, M. Kim, J. Ji, T. Yun, S. Kim, Bhumsuk, "Artificial intelligence-powered spatial analysis of tumor-infiltrating lymphocytes as a predictive biomarker for axitinib in adenoid cystic carcinoma". *Head & Neck.* 2023 Dec.

S. Choi, S. Cho, W. Jung, T. Lee, S. Choi, S. Song, G. Park, S. Park, **M. Ma**, S. Pereira, D. Yoo, S. Shin, C. Ock, S. Kim, "Deep learning model improves tumor-infiltrating lymphocyte evaluation and therapeutic response prediction in breast cancer" *npj Breast Cancer.* 2023 Aug.

S. Park, C. Ock, H. Kim, Pereira S, S. Park, **M. Ma**, S. Choi, S. Kim, S. Shin, J. Aum, K. Paeng, D. Yoo, H. Cha, S. Park, K. Suh, H. Jung, S. Kim, Y. Kim, J. Sun, J. Chung, J. Ahn, M. Ahn, J. Lee, K. Park, S. Song, Y. Bang, Y. Choi, T. Mok, S. Lee, "Artificial Intelligence-Powered Spatial Analysis of Tumor-Infiltrating Lymphocytes as Complementary Biomarker for Immune Checkpoint Inhibition in Non-Small-Cell Lung Cancer." *J Clin Oncol. 2022 Jun 10;40(17):1916-1928.*

S. Choi, S. Cho, **M. Ma**, S. Park, S. Pereira, J. Aum, S. Shin, K. Paeng, D. Yoo, W. Jung, C. Ock, S. Lee, Y. Choi, J. Chung, T. Mok, H. Kim, S. Kim, "Artificial intelligence-powered programmed death ligand 1 analyzer reduces interobserver variation in tumour proportion score for non-small cell lung cancer with better prediction of immunotherapy response", *European Journal of Cancer 170, 17-26*, 2022

H. Cho, S. Cho, S. Choi, W. Jung, J. Shin, G. Park, J. Moon, **M. Ma**, H. Song, M. Mostafavi, M. Kang, S. Pereira, K. Paeng, D. Yoo, C. Ock, S. Kim, "Artificial intelligence-powered whole-

slide image analyzer reveals a distinctive distribution of tumor-infiltrating lymphocytes in neuroendocrine neoplasms", *Diagnostics 12(10)*, 2022

S. Cho, W. Jung, S. Choi, S. Kim, S. Song, G. Park, **M. Ma**, S. Park, S. Pereira, S. Ahn, J. Aum, S. Shin, K. Paeng, D. Yoo, C. Ock, Abstract P4-05-07: "Assistance with an artificial intelligence-powered tumor infiltrating lymphocytes (TIL) analyzer reduces interobserver variation in pathologic scoring of TIL in breast cancer", *Cancer Res (2022) 82 (4_Supplement): P4-05-07.*

G. Park, S. Choi, S. Kim, S. Cho, W. Jung, J. Ryu, **M. Ma**, D. Yoo, K. Paeng, C. Ock, S. Song, H. Song, S. Pereira, S. Park, Abstract: "Artificial Intelligence-Powered Tumor Purity Assessment From H&E Whole Slide Images Correlates with Consensus Purity Estimation Based on Pathological Examination and Nextgeneration Sequencing", *USCAP* 2022

S. Kim, S. Choi, S. Cho, H. Kim, **M. Ma**, S. Pereira, S. Park, J. Aum, S. Shin, K. Paeng, D. Yoo, W. Jung, C. Ock, S. Lee, J. Chung, Y. Choi, Abstract: "Artificial Intelligence-Powered Analyzer Reduces Inter-observer Variation in PD-L1 Tumor Proportion Score of Non-Small Cell Lung Cancer", *USCAP* 2022

S. Kim, S. Choi, S. Cho, H. Kim, **M. Ma**, S. Pereira, S. Park, J. Aum, S. Shin, K. Paeng, D. Yoo, W. Jung, C. Ock, S. Lee, J. Chung, Y. Choi, Abstract: "Artificial Intelligence-Powered Analyzer Reduces Inter-observer Variation in PD-L1 Tumor Proportion Score of Non-Small Cell Lung Cancer", *USCAP* 2022

M. Jung, S. Song, S. Cho, W. Jung, C. Oum, H. Song, **M. Ma**, S. Park, S. Pereira, S. Song, K. Paeng, D. Yoo, C. Ock, J. Sung, S. Kim, "Artificial intelligence-powered human epidermal growth factor receptor 2 (her2) analyzer in breast cancer as an assistance tool for pathologists to reduce interobserver variation. ", *Journal of Clinical Oncology 40(16_suppl)*, 2022

H. Lee, S. Cho, E. Cho, Y. Lim, S. Cho, W. Jung, S. Song, M. Kang, J. Ryu, **M. Ma**, S. Park, K. Paeng, C. Ock, S. Song, G. Gong, "Artificial intelligence (AI)-powered spatial analysis of tumor-infiltrating lymphocytes (TIL) for prediction of response to neoadjuvant chemotherapy (NAC) in triple-negative breast cancer (TNBC)", *Journal of Clinical Oncology 40(16_suppl) 595-595*, 2022

Y. Kim, I. Song, S. Cho, S. Kim, M. Kim, S. Ahn, H. Lee, D. Yang, N. Kim, S. Kim, T. Kim, D. Kim, J. Choi, K. Lee, **M. Ma**, M. Jo, S. Park, G. Gong, "Diagnostic assessment of deep learning algorithms for frozen tissue section analysis in women with breast cancer. ", *J Korean Cancer Assoc 0(0)*, 2022

H. Kim, S. Choi, S. Kim, J. Aum, S. Pereira, S. Park, **M. Ma**, S. Shin, K. Paeng, D. Yoo, W. Jung, C. Ock, S. Lee, J. Chung, Y. Choi, T. Mok, "Clinical performance of artificial intelligence-powered annotation of tumor cell pd-l1 expression for treatment of immune-checkpoint inhibitor (ici) in advanced non-small cell lung cancer (nsclc)", *Journal of Clinical Oncology 39(15_suppl) 9026-9026*, 2021

J. Park, K. Lee, E. Choi, W. Jung, J. Aum, S. Pereira, S. Park, **M. Ma**, S. Lee, E. Baek, E. Roh, S. Shin, K. Paeng, D. Yoo, C. Ock, "Pathologic validation of artificial intelligence-powered prediction of combined positive score of pd-l1 immunohistochemistry in urothelial carcinoma", *Journal of Clinical Oncology 39(15_suppl)*, 2021

Y. Choi, S. Park, S. Pereira, S. Park, **M. Ma**, J. Shin, J. Shin, K. Paeng, D. Yoo, C. Ock, S. Lee, "Distinct subset of immune cells assessed by multiplex immunohistochemistry correlates with immune phenotype classified by an artificial intelligence-powered tissue analyzer in advanced non-small cell lung cancer", *Journal of Clinical Oncology 39(15_suppl)*, 2021

C. Ock, S. Shin, W. Jung, S. Ahn, H. Kim, C. Lee, J. Aum, D. Tak, A. Ryu, T. Chung, E. Baek, J. Shin, S. Lee, J. Shin, **M. Ma**, S. Park, S. Pereira, J. Kang, D. Yoo, K. Paeng, "Artificial intelligence-powered spatial analysis of tumor infiltrating lymphocytes (til) to reflect target gene expressions of novel immuno-oncology agents", *Journal of Clinical Oncology 39(15_suppl)*, 2021

C. Park, Y. Lim, S. Song, S. Ahn, J. Ryu, H. Song, **M. Ma**, S. Park, S. Pereira, B.J. Aum, S. Shin, S. Cho, K. Paeng, D. Yoo, W. Jung, C. Ock, Abstract : AI-powered whole-slide image analysis of tumor-infiltrating lymphocytes for prediction of prognosis in colorectal cancer, *ESMO* 2021

S. Choi, S. Kim, H. Kim, S. Cho, **M. Ma**, S. Park, S. Pereira, B.J. Aum, S. Shin, K. Paeng, D. Yoo, W. Jung, C. Ock, S. Lee, Y. Choi, J. Chung, T.S. Mok, Abstract : Assistance with an

artificial intelligence-powered PD-L1 analyzer reduces interobserver variation in pathologic reading of tumor proportion score in non-small cell lung cancer, *ESMO* 2021

C. Ock, S. Song, G. Park, C. Park, S. Cho, S. Shin, Y. Lim, W. Jung, H. Song, J. Ryu, **M. Ma**, S. Park, S. Pereira, D. Yoo, K. Paeng, "Artificial intelligence-powered spatial analysis of tumor-infiltrating lymphocytes reveals immune-excluded phenotype related to apobec signature and clonal evolution of cancer", *Journal for ImmunoTherapy of Cancer 9(Suppl 2)*, 2021