**The 3rd Workshop on** **Computational Mathematics Modeling in Cancer Analysis (CMMCA2024)**

*A Workshop proposal for MICCAI 2024*

This is a proposal for a workshop on Computational Mathematics Modeling in Cancer Analysis (CMMCA) to be held in conjunction with MICCAI 2024. Our team has effectively orchestrated two CMMCA workshops. The inaugural event, Computational Mathematics Modeling in Cancer Analysis (CMMCA) 2022, took place in conjunction with the 26th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2022) in Singapore, while the second was held in Canada. Noteworthy keynote speakers from esteemed institutions such as Stanford, MD Anderson, Case Western, Sorbonne, and two MICCAI chairs were in attendance. The workshop has attracted >100 of researchers to submit their studies and join the workshop. A total of 15 and 17 papers were successfully published in the proceedings of the 1st and 2nd workshops, respectively. The formation of a diverse global program committee is a highlight, boasting representation from over 20 institutions, including MD Anderson, UAE, Stanford, Cambridge, Duke, and Imperial College London.

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**Workshop Description**

**Scope and Topic:**

Cancer, a multifaceted and heterogeneous ailment, frequently results in misdiagnosis and ineffective treatment strategies. Over the past few decades, numerous mathematical and computational approaches have been employed in foundational cancer research. These approaches have significantly contributed to our comprehension of this intricate spectrum of diseases, fostering the generation of novel hypotheses and predictions. They have also steered scientists towards a new phase of more enlightening and successful experimental endeavors. In the realm of clinical applications, a plethora of mathematical methods dedicated to the analysis of multimodal cancer data has been extensively utilized. These methods play a pivotal role in tasks such as cancer subtype identification, stage classification, prognostic prediction, and various other applications. Rooted in sound mathematical theory and biological mechanisms, advanced computational methods for cancer data analysis prove to be robust and clinically applicable. They offer strong interpretability by seamlessly combining clinical data and algorithms, especially in this era of artificial intelligence. Furthermore, these methods facilitate a profound exploration of cancer from the vantage point of computational science. They enable the mapping of intricate biological and computational correlations across diverse omics data, unveiling insights at various scales and perspectives.

The primary objective of the Computational Mathematics Modeling in Cancer Analysis (CMMCA) workshop is to advance scientific researchers within the expansive realm of computational mathematics in cancer analysis. The workshop will specifically address key trends and challenges in the theoretical, computational, and applied aspects of mathematics in cancer data analysis. It aims to showcase works focused on identifying cutting-edge techniques and their applications in cancer data analysis. We anticipate that the workshop will offer a distinctive platform for in-depth technical discussions and the exchange of ideas across various areas involving mathematical and computational sciences, modeling, and simulations, ultimately contributing novel insights to cancer research and clinical applications.

The workshop's thematic areas encompass, but are not limited to, computational mathematics modeling, including Deep Learning, Differential Equations, Multi-scale Modeling, Cellular Automaton, Spatial Graph Network, Nonlinear Dynamical Systems, and Probability Methods. These modeling techniques find applications in diverse areas, such as but are not limited to:

* Interpretability-based learning mathematics theory for cancer imaging analysis
* Medical image analysis of anatomical structures/functions and tumors
* Computer-aided tumor detection/diagnosis
* Multi-modality fusion for cancer analysis, diagnosis, and surgery/treatment plans
* Molecular/pathologic/cellular image analysis in the microenvironment, immunity, invasion, treatment, and resistance
* Computational modeling characterizing tumor growth, metabolism, and evolution
* Topological tumor graphs for prognosis analysis
* Biologically-based mathematical modeling in tumor vasculature and angiogenesis
* Spatiotemporal modeling for heterogeneity and evolution of the tumor microenvironment
* Digital twin for clinical trial design, precision medicine, and drug discovery

**Academic Objectives:**

The primary academic goal of the CMMCA workshop is to convene mathematicians, biomedical engineers, computer scientists, and physicians in order to deliberate on innovative mathematical approaches for analyzing multimodal cancer data. These approaches are intended for practical application in clinical settings, addressing crucial tasks such as cancer subtype classification and prognostic prediction. The workshop's secondary objective is to encourage researchers to put forth novel methods for cancer data analysis that prioritize interpretability. This involves integrating clinical data with algorithms grounded in robust mathematical theories, facilitating a more profound exploration of cancer through the lens of computational science. Such exploration includes mapping biological and computational correlations across multiple omics data at various scales. The scope of multimodal cancer data encompasses, but is not limited to, radiographic, pathology, genomics, and proteomics data.

**Diversity Plan**

*Organizing Committee:*

We recognize the importance of diversity within the organizing committee to ensure varied perspectives in decision-making. In our past meeting committee, we have included women and researchers from under-represented groups and low-income countries. Our plan for CMMCA 2024 involves outreach to diverse professional networks, engaging in targeted recruitment efforts, and actively seeking nominations from individuals belonging to underrepresented groups. We will implement blind review processes to ensure unbiased selection and provide training on diversity and inclusion to committee members.

*Speakers and Invited Participants:*

To amplify diversity among speakers and invited participants, we commit to expanding our outreach efforts beyond traditional networks. This includes actively seeking out experts and thought leaders from underrepresented racial and ethnic groups, individuals with disabilities, individuals from disadvantaged backgrounds, and women. Additionally, we will establish partnerships with organizations dedicated to diversity in our field to identify and invite diverse speakers. Transparent selection criteria and blind review processes will be applied to ensure fairness.

*Audience:*

Our goal is to create an inclusive audience that reflects the diversity of the community we serve. Outreach initiatives will target underrepresented groups, including local communities, educational institutions, and organizations with diverse memberships. We will offer travel award, reduced registration fees, and facilitate networking opportunities to encourage participation from individuals facing financial barriers. Feedback mechanisms will be implemented to assess the effectiveness of these initiatives.

**Duration**

We propose to hold a full day workshop on October 6th, 2024.

**Expected Numbers**

From the organizers’ experiences with CMMCA’2022 and 2023 in conjunction with MICCAI. We expect the workshop to be well attended with 50-100 people this year.

**History Of CMMCA**

We have effectively orchestrated two CMMCA workshops. The inaugural event, CMMCA 2022, took place in conjunction with the 26th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2022) in Singapore, while the second was held in Canada. Noteworthy keynote speakers from esteemed institutions such as Stanford, MD Anderson, Case Western, Sorbonne, and two MICCAI chairs were in attendance. The workshop has attracted >100 of researchers to submit their studies and join the workshop. A total of 15 and 17 papers were successfully published in the proceedings of the 1st and 2nd workshops, respectively. The formation of a diverse global program committee is a highlight, boasting representation from over 20 institutions, including MD Anderson, UAE, Stanford, Cambridge, Duke, and Imperial College London. Additionally, we are pleased to report that Sanmed Biotech has generously provided support, covering meeting costs and facilitating awards. These achievements collectively underscore our commitment to fostering collaboration and innovation in the field.

The CMMCA 2023 workshop site <https://cmmca.github.io/cmmca2023/> and proceeding <https://link.springer.com/book/10.1007/978-3-031-45087-7>

**Preliminary Program**

CMMCA 2024 will feature a single-track workshop with keynote speaker(s), technical paper presentations, poster sessions, and demonstrations of the state-of-the-art computational mathematics model for cancer data analysis. People from academic, clinical, and industrial fields would be interested in the workshop and are expected to participate. Importantly, as the number of practicing physicians attending MICCAI has been increasing these days, they would be interested in the advancing of practical clinical decision support systems based on computer-aided analysis of multimodal data. Industry participation from medical imaging and pharmaceutical companies is also expected.

**Balance**

In order to ensure equality and diversity of the workshop. Our organizing team includes different areas (Asian, North America, Europe), nationality and gender. All presentations will be selected from paper submission based on peer-review scores. The invited speaker also will consider different areas and various background from research, clinical and industry. The final program will consist of previously unpublished papers, with substantial time allocated for discussion.

**Review Process**

Papers will be limited to eight pages and enabled for double-blind reviewing. All submissions will be peer-reviewed by at least 2 members of the program committee. The selection of the papers will be based on the significance of results, technical merit(s), relevance, and clarity of presentation.

**Proceedings**

The CMMCA2024 proceedings will be published as a volume in the Springer Lecture Notes in Computer Science (LNCS) series in conjunction with MICCAI 2024.

**Specific Requirements**

A room that can accommodate 50-100 people would be expected, along with the facilities such as a laptop, a projector and microphones. Poster area in the nearby is also requested.