6th Annual LLU Algorithm Workshop

Comet Neowise C/2020 F3 seen from Southern California on July 17, 2020

Contents

General Information

We continue our series of yearly workshops, which have been centered on topics related to algorithms for reconstruction and optimization of **particle imaging** and **intensity-modulated proton therapy**. This year's Workshop will take place **entirely online** from **July 20-22,** as always, right after the AAPM conference.

The summer workshops at Loma Linda s are intentionally organized in an informal setting: this is a workshop and not a conference that is planned in all detail with assigned sessions and speakers. Students and faculty alike present their recent work and ideas; often, decisions about talks are made last minute and added to the program. This year's edition will repeat this format. Still, you may notice the **gradual change towards a widened scope** with new topics such as Artificial Intelligence becoming more prominent. However, our focal point will remain protons and ions. The Workshop intends to create a significant overlap between different topics and different disciplines (mathematics, computer science, radiation therapy) that will enable us to work intensively together, exchange information and ideas, and finalize and start new projects. Ongoing projects are often discussed during the Workshop, for which we will offer breakout rooms.

Contact Email Addresses of Workshop Organizers

Reinhard Schulte, rschulte@llu.edu, Principal Workshop Host, Loma Linda University (medical physics and radiation oncology).

Yair Censor, yair@math.haifa.ac.il, University of Haifa (applied mathematics).
Walaa Moursi, walaa.moursi@uwaterloo.ca University of Waterloo (applied mathematics).
Katia Parodi, Katia.Parodi@physik.uni-muenchen.de, LMU Munich medical physics research).
Keith Schubert, keith_schubert@baylor.edu, Baylor University (computer science and engineering).
Nils Krah, nils.krah@creatis.insa-lyon.fr, University of Lyon, CNRS, Creatis lab, (medical imaging research).

How to Participate?

It is easy for invited attendees to participate in the Workshop using the Zoom interface to join the individual sessions (see the program at the end), interact with other participants and the organizers, and share your slides or other materials. Use the details below to join the Zoom event:

Zoom Event Details:

Topic: 6th Annual Workshop Zoom Meeting, July 20-22, 2020, 8 AM - 5 PM, CDT, 1 PM - 10 PM UTC
Time: Jul 20, 2020, 06:00 AM Pacific Time (in the US and Canada)

https://llu.zoom.us/j/91629823279?pwd=YjFMSURCdXlsMlNIUzlHcmJnckFUQT09

Meeting ID: 916 2982 3279
Password: This was emailed to you the night before the meeting

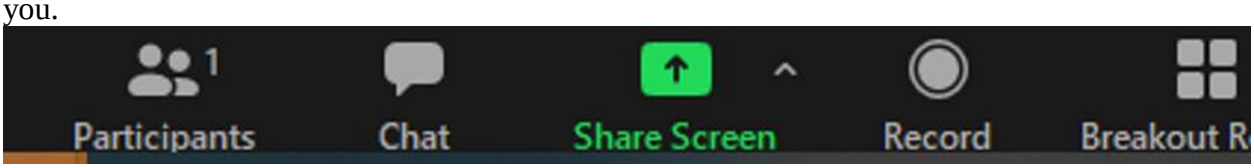
NOTE: When you're not actively part of the conversation, please keep your microphone muted to reduce background noise. Only the host and the speaker should enable their video.

Can I share the Zoom Link and Password?

Several of you told me they would like to share the event link with friends, colleagues, and students. Feel free to do so. The workshop host will admit participants who request admission to the Workshop from the waiting room and may ask attendees whether somebody was invited who wants to get into the room. We want to avoid interference by Zoom-bombers.

How do I share my presentation slides?

The easiest way is to share your slides on your computer by clicking on the green box in the Zoom menu (see screenshot below). If you cannot share, please send your presentation file to the principal host (rschulte@llu.edu) before it is your turn. He will share and advance the slides for you.



Can I watch a presentation that I missed later?

All presentations will be recorded on the Cloud. If the presenter agrees, the presentation recording will be made available to attendees on the event website (ionimaging.org) using a password-protected link.

How do I ask questions during the presentations?

Due to online-format, we need to be time-minded this time. Please post your questions in the chat window of the Zoom application (click on the Chat icon shown in the screenshot above). If time allows, the session host will allow you to ask the questions until the next session begins.

Can I talk to the presenter later in the day?

There will be breakout rooms for the individual speakers after each session block during the Coffee break, the Lunch break, and at the end of the meeting. Each speaker will be asked to stay around or be back to discuss their talk with participants. Speakers that cannot come back on their day of the presentation can still have a breakout room the next day (except for Wednesday).

Can I organize a project meeting during the Workshop?

You can ask the principal host to create a project breakout room. The request should be made by the participants who want to meet and discuss a particular project, and the host will assign a breakout room to them.

Fun Things

We are aware that doing something fun together has been part of the Loma Linda Workshop attraction. Last year, preworkshop participants joined a trip to Joshua Tree National Park to watch the night sky through telescopes. This year, we would have looked at Comet Neowise 2020 (see front photo). To make up for this, the principal host will connect you to large remote telescopes on Tenerife Island or in Chile to watch astronomical objects. The event will be in one of the Breakout Rooms after the meeting ends on Monday and Tuesday at 5:30 PM CDT for

about 30 minutes, also on Wednesday. We will also create a Social Breakout Room after each meeting day at 6 PM CDT, where you can bring your favorite drink and chat with other participants about anything you want, including politics, but not only, please.

Workshop Program by Day

Time (PDT)	Monday, July 20
6:00 AM	Yair Censor: **The role of superiorization as a tool between feasibility and optimization (Educational Lecture)**
7:00 AM	Coffee Break/Breakout Groups
	Howard Heaton: **Adversarial Projections for Inverse Problems**
8:00 AM	Daiki Hayakawa: **Development of iterative image reconstruction for track-based multiple scattering CT using a high-energy electron beam**
	Nigel Allinson: **OPTIma - coping with more protons than you really need?**
9:00 AM	Walaa Moursi: **On the Douglas–Rachford algorithm**
	Jakub Baran: **An update on J-PET for the beam range monitoring in proton radiotherapy**
10:00 AM	Florian Pitters: **Ion Beam Imaging Activities at TU Wien and the Austrian Institute of High Energy Physics**
	Arthur Lalonde: **Projection-based CBCT correction using Monte Carlo simulations and deep convolutional neural networks for adaptive head and neck proton therapy**
11:00 AM	Carla Winterhalter: **Optimising Monte Carlo (GATE-RTion/GATE/Geant4) settings for clinical proton therapy**
	Hanh Nguyen, Tierra Folley: **Deep Learning in Medical Image Analysis**
12:00 PM	Lunch/Dinner Break/Breakout Groups
1:00 PM	Kirk Duffin: **Quaternions for Rotation and Orientation: An Overview**
	Christina Sarosiek: **Optimizing the relaxation parameter for iterative pCT reconstructions**

2:00 PM	Ethan DeJongh: **Experimental Results from a Prototype Clinical Proton Imaging System**
	Abdelkhalek Hammi: **Proton Radiography - A Tool Quantitative Imaging of Anatomical Changes in Head and Neck Patients**
3:00 PM - 4:00 PM	Breakout Groups

Time (PDT)	Tuesday, July 21
6:00 AM	Lei Xing: **Applications of Artificial Intelligence in Imaging and Treatment Planning (Educational Lecture)**
7:00 AM	Pierluigi Piersimoni: The single sided digital tracking calorimeter designed and developed by the Bergen pCT group
	Lennart Volz: C**omparing imaging modalities in homogeneous and heterogeneous tissues: status report on our PTCOG funded project**
8:00 AM	Esther Bär, **Particle versus photon imaging for proton radiotherapy - an experimental comparison**
	Lucas Burigo: **Monte Carlo Interface to matRad for Proton Dose Calculations**
9:00 AM	Coffee Break/Breakout Groups
	George Dedes: **Prescribing image noise using dynamic fluence field optimization: experimental results using a pre-clinical proton CT scanner**
10:00 AM	Jannis Dickmann: **Joint dose minimization and variance optimization for fluence-modulated proton CT**
	Marcin Pietrzak, Beata Brzozowska: **An overview on Jet Counter experimental nanodosimetry and track structure simulations**
11:00 AM	Feriel Khellaf: **A deconvolution method to improve spatial resolution in pCT**
	Prasanna Palaniappan: **Deformable image registration of the treatment planning CT with proton radiography in the perspective of adaptive proton therapy**
12:00 PM	Lunch/Dinner Break/Breakout Groups

1:00 PM	Tai Dou: **A deep learning-based model for predicting machine failures in a proton therapy system**
	Nils Krah: **Scattering proton CT**
2:00 PM	Dan Low: **Replacing 4DCT: It's about time!**
	Stuart Rowland, Sherif Gadoue: **Motion Adapted Reconstruction**
3:00 PM - 4:00 PM	Breakout Groups

Time (PDT)	Wednesday, July 22
5:30 AM	Seyed Mohsen Husseini: **Proton CT image improvement with machine learning - a new project**
6:00 AM	Lembit Sihver: **The PHITS Monte Carlo Particle Transport Simulation Code (Educational Lecture)**
7:00 AM	Jan Gajewski: **Commissioning of GPU-accelerated Monte Carlo code Fred for clinical applications in proton therapy**
	Magdalena Garbacz: **A computational study on variable RBE using clinical data of patients treated with protons in Krakow**
8:00 AM	Catarina Veiga: **Image analysis for lung radiotherapy toxicity**
	Xiaodong Zhang: **Development of NTCP models for Proton Therapy**
9:00 AM	Coffee Break/Breakout Groups
	Andrew Best: **The Impact of Proton Range Uncertainty on NCTP in Head and Neck Tumors - A New Project**
10:00 AM	Felix Mas: **Beam energy measurement using Time-of-Flight and innovative Ultra-Fast Silicon Detectors in proton therapy**
	José Ramos-Mendez: **A strategy to develop a Monte Carlo track-structure model for the reaction kinetics in biological tissue**
11:00 AM	Naoki Dominguez: **DNA Damage Simulations on TOPAS-nBio/Geant-DNA: Current State and Future Plans**

12:00 PM	Omar R. Garcia: **TOPAS-nBio implementation for handling temperature-dependent radiochemical yields**
	Lunch/Dinner Break/Breakout Groups
1:00 PM	Jan Schuemann: **FLASH Proton Therapy – Potentials and Pitfalls**
	James Keal: **Simplex noise as training data for learned 3D dose calculation**
2:00 PM	Anatoly Rosenfeld: **Microdosimetry-based Treatment Planning in Proton Therapy**
	Susanna Guatelli: **G4_Med, a Geant4 benchmarking tool for medical physics applications**
3:00 PM - 4:00 PM	Breakout Groups
	Reinhard Schulte, **Workshop Summary and Adjourn**