ESMPE European School for Medical Physics Experts

Artificial Intelligence in Medical Physics

Online course (from December 2022)

EFOMP would like to invite you to the next ESMPE in AI in medical physics. The school will be organized as pre-course in remote with self-training (**AI course part 1**) plus a 2.5 days face to face meeting (advanced **AI course part 2,** which will be held in October 2023). The school is organized in collaboration with COCIR.

The online course is preparatory to the AI part 2 course. Participation in the part 2 course requires that you have taken (self-study) the online course.

The school will be focused on the medical physics aspects of artificial intelligence and will be aimed at presenting the background, practical methodology, state-of-the-art and future developments of AI.

This course (remote self-training and evaluation) is intended for medical physicists who wish to expand their knowledge in artificial intelligence. Certificates of attendance will be issued to those who attend the whole course (part 1 and part 2)**.**

Content for the remote training

The strategic role, competence and education of medical physicist in the era of AI

- Medical Imaging analysis
- Basics of machine learning (ML) and deep learning (DL) in imaging
- Introduction on how to develop AI applications
- Role of the MP: how to deal with AI-based commercial solutions
- Big Data and Enterprise Imaging
- Radiomics
- Quality, Regulatory and Ethical issues

Organisers

Federica Zanca (Chair of the School), **Alberto Torresin** (Chair of the School),

Brendan McClean (Chair of the ESMPE)

Efi Koutsouveli (EFOMP Secretary General) and **Christos Alexakos** (ESMPE online platform)

Faculty

Name
Mika Kortesniemi
Osvaldo Rampado
Francesca Botta
Berend Stoel,
Nicola Maffei
Oleksandra V. Ivashchenko
Michele Avanzo
Ana Barragan
Matteo Maspero
Andrea Barucci
Tiziana Rancati
Ana Jiménez Pastor
Oliver Diaz
Harmon, Stephanie
Brouwer Charlotte
Hilde Bosmans
Kathleen Curran
Lidia Stringari
Floris van Velden
Emmanuele Neri
Alberto Traverso
Fanny Orlhac
Filippo Pesapane
Caterina Brusasco
Patrick Reichmann
Zuzanna Kwade
Kicky van Leeuwen
Gabriele Guidi
Matilde Ratti

	Topic	Sub-Topic	Lecturer
1	The strategic role, competence and education of medical physicist in the era of AI	The philosophy of AI	Mika Kortesniemi
2	Medical Imaging analysis and background for AI	Image reconstruction in CT, MRI : from traditional to AI methods	Osvaldo Rampado
		Image reconstruction in PET and SPECT: from traditional to AI methods	Francesca Botta
		Segmentation, feature Extraction, Classificaiton, Registration and Visualiztion of Radiological Images	Berend Stoel
		Image quantification metrics. Which images can I use for a correct quantification of the information content represented by the digital matrices	Nicola Maffei
3	Practical	Image processing tools relevant for AI: Freeware tools applied to automatic 2D/3D segmentation, ROI/VOI extraction and features	Michele Avanzo
4		ML classes: clustering algorithms, support vector machines (SVM), decision trees / random forest learnings, reinforcement learning, and others.	Ana Barragan
		Differences between ML, DL and traditional CAD (computer-aided diagnosis)	Ana Barragan
		Representative power of neural network. Examples in medical imaging.	Matteo Maspero
		Introduction to Deep Learning focusing on Concolution Neural Networks	Andrea Barucci
		An overview of basic NN structure and various architectures with focus on convolutional neural networks (CNN)	Andrea Barucci
		Exploring some prominent CNNS	Andrea Barucci
		Training a network and the standard terminology: loss function, regularization, underfitting/overfitting, stochastic gradient descent (SGD), batch, epoch, backpropagation, inference/prediction/forward pass, hyperparameter optimization, activation maps, data augmentation, adversarial training	Andrea Barucci
		Terminology and common approaches (validation, train and test set division, class imbalance, cross-validation, conformance to TRIPOD statement	Tiziana Rancati
		Basic statistics: sensitivity, specificity, accuracy (etc.), F1 score, Receiver Operating Characteristic (ROC), Area Under the ROC curve, confidence intervals (CI), statistical significance	Tiziana Rancati

	Topic	Sub-Topic	Lecturer
5	Overview of AI development and deployment	Clinical problem definition and selection of the AI technology, data colleciton, data annotation, training, testing, validation, federated approach	Ana Jiménez Pastor
		Accessing, curating and preparing imaging data	Oliver Diaz
		Implementaiton of AI applciaiton	Oliver Diaz
		GPU, workstations, external scientific computing services, cloud computing, hybrid computing solutions	Harmon, Stephanie
6	Role of the MP: how to deal with AI-based commercial solutions	How to buy AI ?	Kicky Van Leeuwen
		Acceptance and commissioning of AI tools in clinical workflow	Brouwer Charlotte
		QA of AI tools	Hilde Bosmans
7	Big data and Enterprise Imaging	Basic principles of Enterprise Imaging Existing standards and platforms How to define key performance indicators for leveraging big data information EI in the context of AI	Kathleen Curran
8	Leveraging Big Data and Enterprise Imaging Radiomics	Basics of imaging biomarkers and radiomics	Lidia Stringari
		Overview of tools on the market for imaging biomarkers	Lidia Stringari
		Standardization initiatives (e.g. IBSI) in imaging biomarkers	Floris van Velden
		Imaging biobanks	Emmanuele Neri
		Radiomics workflow	Alberto Traverso
		Challenges for multi-centers radiomics studies: features robustness analysis and AI support methods to harmonize data	Fanny Orlhac

	Topic	Sub-Topic	Lecturer
9	Quality, Regulatory and Ethical Issues	International Law and data exchange iCloud (case example) General data protection regulation (GDPR), and HIPPA when dealing with data from countries outside EU, i.e. USA. AI process, decision making and ISO 9004 certification standard - Disaster Recovery solution	Filippo Pesapane
10	Quality Assurance and Regulatory Affairs (QARA)	European MD software approval process and regulation (leading to CE mark)	Caterina Brusasco
		Differences between European and US (FDA) software approval roads and regulation.	Caterina Brusasco
		Current regulation for developing AI software as a medical device (MDR), both for commercial and in-house use	Patrick Reichmann
		Further testing of such FDA/CE marked tools in a real clinical context	Zuzanna Kwade
		The (economic) value of AI: a cost item or a cost saver?	Kicky van Leeuwen
		Cybersecurity challenges and TRUSTWORTHY AI in Healthcare - review and state of art	Gabriele Guidi
11	Quality Assurance and Regulatory Affairs (QARA)	AI tools	Matilde Ratti
		AI and data protection	Matilde Ratti
		AI risks	Matilde Ratti
		AI in medical physics and reserach: some conclusions	Matilde Ratti

Course language	English
Level	Medical Physics Expert (MPE)
Registration fee*	Open ONLY to Individual Associate Members of EFOMP with addition fee of 70 €
Reduced registration fee* • subsidized by EFOMP	35 € - for the attendees coming from the following European countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Greece, Hungary, Latvia, Lithuania, Moldova, North Macedonia, Poland, Portugal, Romania, Serbia, Slovak Republic, Slovenia, Ukraine.
Maximum number of participants	Unlimited for remote part
Duration	40 lessons on line
Study load	16h online
Facility	Online using the EFOMP e-learning platform
Website:	www.efomp.org
Information, programme at:	www.efomp.org
Registration	Electronic registration via EFOMP website
Registration period	No time limit for registration

*reduced registration is reserved for Individual Associate Members of EFOMP

Follow ESMPE editions on
EFOMP website
EFOMP Twitter
EFOMP LinkedIn
EFOMP Facebook
EFOMP Instagram