RESEARCH TOPIC DASMEN4
Technical implementation of Artificial Intelligence algorithms to automate the Total Marrow Lymph-nodes Irradiation
Curriculum DASMEN Standard

Laboratory name and address
Radiotherapy and Radiosurgery Unit, IRCCS Humanitas Clinical and Research Hospital
Dipartimento di Fisica "Giuseppe Occhialini", Università degli Studi di Milano-Bicocca

Datascience Supervisor
Pietro Mancosu
pietro.mancosu@humanitas.it

Prof. Isabella Castiglioni
isabella.castiglioni@unimib.it

Research Supervisor
Prof. Roberto Rusconi
roberto.rusconi@hunimed.eu

Abstract
Total Marrow Lymph-nodes Irradiation (TMI/TMLI) is a promising modern radiotherapy technique used for facilitating the donor transplant acceptance in bone marrow transplantation (BMT) patients. TMI/TMLI allows sparing non-skeletal/lymphoid structures while increasing the dose to the BM. TMI/TMLI adoption is still limited due to the difficulty in planning that needs many days.
The aim of this project is to develop artificial intelligence (AI) algorithms to automate the TMI/TMLI planning procedure.
Different projects will be settled, adopting an incremental approach: (i) Automated isocenters positioning and jaws aperture setting; (ii) Knowledge-based (KB) AI and data-mining methods to automate the TMI/TMLI planning; (iii) Automated junction optimization between the two (head-first and feet-first supine) CT series; (iv) Creation of a Synthetic WB-CT from the WB-MRI. Furthermore, she/he will support the other project members from Politecnico Milano in the automatic CT image segmentation.

Main technical approaches
- Open-source programming languages
- supervised and unsupervised machine learning models
- using among others the following languages and functions: SQL, Python, Numpy, Pandas, Sklearn Scipy, Tensorflow
- KB AI will be performed using the commercial software Eclipse (Varian)

Scientific references

1.   Wong JYC, Filippi AR, Scorsetti M, Hui S, Muren LP, Mancosu P. Total marrow and total lymphoid irradiation in bone marrow transplantation for acute leukaemia. Lancet Oncol. 2020;21:e477-e487.

2.   Teruel JR, et al. Automatic treatment planning for VMAT-based total body irradiation using Eclipse scripting. JACMP 2021;22(3):119-130.

3.   Mancosu P, Navarria P, Castagna L, et al. Plan robustness in field junction region from arcs with different patient orientation in total marrow irradiation with VMAT. Phys Med. 2015;31:677-82

4.   Fogliata A, Reggiori G, Stravato A, et al. RapidPlan head and neck model: the objectives and possible clinical benefit. Radiat Oncol. 2017;12:73.

5.   Nogues I, Lu L, Wang X, et al. Automatic lymph node cluster segmentation using holistically-nested neural networks and structured optimization in CT images. MICCAI; 2016:388–397.

Type of contract

Scholarship of € 21.000 gross per year awarded by Istituto Clinico Humanitas. This sum is subject to IRPEF income tax and exempt from social security contributions.

Borsa di studio pari a € 21.000 annui lordi erogata da Istituto Clinico Humanitas. Importo soggetto a tassazione IRPEF ed esente da contribuzione previdenziale.

Humanitas University
Via Rita Levi Montalcini 4
20090 Pieve Emanuele (Milano) Italy
Tel +39.02.8224.1 - Fax +39.02.8224.2394
info@hunimed.eu
Website: www.hunimed.eu
C.F. 97692990159