M.Sc. project in Medical Physics

Use of Bayesian networks in quality control of radiotherapy treatment

The department

Radiotherapy uses ionizing radiation to irradiate tumour tissue to a high dose while sparing the surrounding normal healthy tissue as much as possible. The cluster radiotherapy of the Antoni van Leeuwenhoek hospital uses the most modern techniques to irradiate its patients. Due to the synergy between clinic implementation groups and medical physics research, we are able to quickly implement state of the art techniques in daily clinical practice. Because of this, the Antoni van Leeuwenhoek hospital belongs to the (inter)-national forefront of clinical radiotherapy.

The project

To ensure the safe delivery of the radiation, various checks are routinely performed. One of those is developed a control on the multitude of technical parameters (radiation energy, radiation dose, scale of beam modulation, etc.) that characterizes a radiotherapy treatment. This control automatically classifies each treatment according to disease site and treatment technique and next, for each classification thresholds of acceptance are defined. If a particular treatment exceeds one of these classifications, an additional check by a medical physicist is automatically initiated.

While being an effective tool for quality control, one of the main drawbacks is that the classification rules and thresholds have to be set by hand. In order to resolve this issue, we wish to develop a control system based on a probabilistic network for error detection. In literature, Bayesian network are described for tasks like this, which consists of joint probabilities that define the probability of a particular event, given a set of other events. By populating the network with the same technical parameters we currently use in our the quality control described above, we should be able to classify outliers based upon the probability of that particular combination of parameters.

In this project, you will design and develop an appropriate Bayesian network. Next, you will study the applicability to use this approach as a means of quality control in our department. Apart from learning from the practical application of Bayesian networks and machine learning, you will have the opportunity to experience daily practice at a medical physics department with a strong focus on research and innovation.

Interested?

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