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Response adaptive design for clinical trials: A Markov decision process model for sequential chemotherapy treatment planning

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Clinical trials play an increasingly important role in determining how treatment regimens are effective and safe. Treatment trials are the most common type of trials aimed at finding the best treatments causing the minimal side effects. They serve as a standard technique for evaluating chemotherapy treatment plans used to improve cancer treatment and care. Adaptive trials, on the other hand, test sequential treatments to select the appropriate treatment regimen in accordance with the patient's condition. In fact, the intensity of advising the treatment regimen varies in response to the patient's needs. We propose such a design using a Markov decision process (MDP) model for selecting the optimal policy of cancer chemotherapy treatment regimen according to the patient's condition. The developed MDP model employs novel optimal cancer chemotherapy treatment regimens resulted from an optimization model which relies on previously published clinical trials. In this way, the MDP model benefits from the results of optimization model which propose the most-promising and cost-effective new chemotherapy combinations. Hence, the proposed approach takes the impact of the patient's response to the treatment regimen into account and proposes the most-promising dynamic treatment regimens also costing reasonable. Results show that the proposed approach yields the optimal sequence of chemotherapy treatment regimens for a period of chemotherapy treatment which makes possible designing clinical trials for sequential treatments. Comparing to the existing implemented clinical trials, we show that our proposed design significantly improves both health outcomes and treatment costs of patients.

Biography

Nazila Bazrafshan has completed her M.Sc. in industrial engineering at Yazd University, Iran, in 2015. Her research interests are cancer treatment planning and medical decision-making.

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