

Expert neural network for anti-angiogenic therapy in cancer treatment

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The aim of the talk is to describe an expert system allowing to help of a physician to diagnose a kind of chemotherapy. In literature we have many papers treating the subject of cancer therapy from the theoretical (mathematical) point of view. There are many mathematical models describing the growth of tumor as well as its killing methods. We choose for our investigations the mathematical model and its theoretical studies as well some solutions from works written by U. H. Ledzewicz and H. Schaetler (see e.g. [1], [2], [3]). The most important idea in their papers is applying anti-angiogenic therapy in cancer treatment as an optimal control problem and next underlying that singular arc in state space (formed by growth of tumor and capacity of vasculature) is a part of optimal arc in that space. The investigations in those papers are theoretical and even calculated the optimal synthesis of controlled trajectory is not much helped for physician to determinate a proper therapy for given patient with special for him/her data - the quantity of tumor and capacity of vasculature as well several parameters occurring in the mathematical model.

Our task is to discretize the space of state and the space of parameters occurring in the model. Next we use the investigations of U. H. Ledzewicz and H. Schaetler and our own numerical method of solving optimal control problem from [1] to calculate for each given point of discretised space optimal (near optimal) trajectory for therapy. We treat obtained results as patterns to construct an artificial neural network called SONN. The feature of the SONN is that it recognizes patterns in 100% and for data being small disturbed from the pattern the recognition is near 100%. The goal of the neural network is for given initial data (growth of tumor, capacity of vasculature and parameters) to answer a type of anti-angiogenic therapy for a particular patient.

References

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- [3] U. Ledzewicz, J. Marriott, H. Maurer and H. Schättler, Realizable protocols for optimal administration of drugs in mathematical models for anti-angiogenic treatments, *J. of Medical Biology*, under review