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A neural network-based approach for predicting outcomes after hypofractionated gamma-knife radiosurgery for large brain metastases

Hyeong Cheol Moon, Jae Hoon Woo, Kyoung-Ha So, Daae Lee, Young Seok Park and Hong Rae Kim
Chungbuk National University Hospital, South Korea

Predictions of patient outcomes after radiotherapy are essential to medical practice with the neurosurgeon, oncologist and medical physicist. Stereotactic Radiosurgery (SRS) is commonly used for brain metastases that are 3cm or smaller in maximum diameter. Fractionation was introduced that the total dose of radiation is divided into small doses over a period of several days; there are fewer toxic effects on healthy cells. However, LINAC-based SRS have reported some studies, but Gammaknife Radiosurgery (GKRS) based has been rarely reported. We employed neural network approach towards predicting the outcomes after hypo fractionated GKRS to large brain metastatic brain tumors (>3cm). Features engineering in this database included standard clinical and GKRS treatments parameters. A neural network consists of feed-forward which is the most well-known many applications in the functional approximation and back-propagation network is used for training. Our training process was performed Keras tools of categorical cross-entropy in lost function and Stochastic Gradient Descent (SGD) for optimization. A learning rate of $1.0x10^{-6}$. The best accuracy had around 95% and error under 0.05 in multi-layer neural networks. And single neural networks showed around 90% accuracy. This neural network approach was able to provide the best prediction of large brain tumor outcomes under hypo fractionated treatment. Furthermore, we could demonstrate a paradigm for personalized treatments for further development tools in medical care.

Biography

Hyeong Cheol Moon is currently working as a Medical Physicist at Chungbuk National University Hospital. He has published more than 10 papers in reputed journals. He is interested in ultra-high field 7T MRI, quality assurance for gammaknife radiosurgery and artificial neural network.

jimmun@cbnuh.or.kr

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