# System and method for automated fluence map prediction and radiation treatment plan generation

## Unmet Need

Cancer is a leading cause of death worldwide, with almost 10 million deaths and over 19 million new cases in 2020. These numbers are expected to grow, with 28 million new cases estimated to be diagnosed in 2040. Some of the most effective therapies for cancer are based around beams of radiation applied by an external source, such as intensity-modulated radiation therapy (IMRT) and stereotactic body radiation therapy (SBRT). External radiation therapy is an almost $6B a year market, which is expected to grow at a CAGR of about 6.3% to almost $8B by 2023. However, these types of radiation treatments have to be planned for each individual patient so that the beams deliver the maximum dose to the target tumor while sparing nearby healthy tissue and organs at risk (OAR), a time-consuming process managed by a team of clinical professionals. These professionals can use software to more efficiently plan parts of the radiation treatment, but there are no currently available software solutions that can predict beam fluence maps for multiple planning target volumes (PTV) and integrate into fully-automated treatment planning solutions. Currently, fluence maps are usually inversely optimized by human planners, an iterative and slow process. There is a need for software that can automatically predict fluence maps and integrate with existing radiation treatment planning software.

## Technology

Duke inventors and colleagues have developed a software system and method for the automated prediction of fluence maps and subsequent radiation treatment plan generation. This software intakes

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#### Meet the Inventors

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#### Publication(s)

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#### External Link(s)

• From the lab of Dr. Jackie Wu

patient anatomy data and treatment goals, then uses deep learning neural networks to predict field dose distribution. This informs deep learning-based predictions of corresponding beam's eye view projections from which a final fluence map per beam is predicted. These fluence maps have been validated across dozens of retrospective pancreatic, prostate, and head-and-neck cancer cases, delivering treatment plans clinically comparable to those designed by human planners. This software is getting ready to enter clinical use soon.

## Advantages

- Eliminates the need for time-consuming, manual inverse planning from fluence maps
- Can be used on multiple PTVs within a single case
- Can be integrated into existing software approaches or combined with other tech by Dr. Wu and colleagues to create a one-stop, fully automated solution for radiation treatment planning
- Fluence map prediction takes just a few seconds, fully automated plan generation takes just a few minutes
- Deep learning model can be retrained on patient data from other anatomical regions to create fluence maps for different radiation treatment approaches and instruments, as well as different cancer types and sites