

# Systems and methods for automatic radiation treatment plan generation and evidence-based customization for breast cancer

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## Unmet Need

Breast cancer is now the most commonly diagnosed form of the disease, with 2.3 million new cases in 2020. 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 whole breast radiation therapy (WBRT). 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 mostly relying on personal experience. The complexity and time commitment of manual breast treatment planning impedes the physician's ability to provide optimal care for their patients. There is a need for software that can quickly and automatically plan breast cancer radiation treatment plans that can be adjusted for each individual patient.

## Technology

Duke inventors and colleagues have developed software systems and methods for automatic and customizable radiation treatment plan generation for breast cancer. The software takes in patient case and radiation therapy system data, performs an analysis using a knowledge model built using machine learning trained on data from similar breast cancer treatments, and presents a patient-specific radiation treatment plan. This plan and process can further be tweaked to account for physician and patient preference, but the software-generated plans are clinically comparable to human-produced plans. This technology has been successfully deployed at Duke Cancer Center clinics since May 2019 and has helped treat over 1,300 breast cancer patients.

## Other Applications

This technology could also be applied to other cancer types



### Duke File (IDF) #

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### Links

- [From the lab of Dr. Jackie Wu](#)

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and sites, as well as other instrumentation.

## Advantages

- Extensively validated in the clinic, with strong positive feedback from radiation planning teams
- Faster plan design, on the order of several minutes compared to several hours, allowing for more approaches to be analyzed more efficiently
- One-stop software includes fluence prediction, removing the need for manual planning dose calculation

## Publications

- [Clinical Experience With Machine Learning-Based Automated Treatment Planning for Whole Breast Radiation Therapy \(Advances in Radiation Oncology, 2021\)](#)
- [Automatic Planning of Whole Breast Radiation Therapy Using Machine Learning Models \(Frontiers in Oncology, 2019\)](#)
- [Goal-Driven Beam Setting Optimization for Whole-Breast Radiation Therapy \(Technology in Cancer Research & Treatment, 2019\)](#)
- [US Patent App 15/776,145](#)

## Patents

Patent Number: 11,065,471

Title: SYSTEMS AND METHODS FOR AUTOMATIC CUSTOMIZED RADIATION TREATMENT PLAN GENERATION FOR BREAST CANCER

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