

Developing Physics-Based High-Resolution Head And Neck Biomechanical Models

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SUMMARY

UCLA researchers in the Department of Radiation Oncology at the David Geffen School of Medicine have developed a new computational method to model head and neck movements during medical imaging/treatment procedures.

BACKGROUND

Radiation therapy is the primary treatment for many head and neck cancers. Further, this treatment is generally tailored to the patient's response to the therapy (i.e. radiation dose). However, while radiation therapy is a powerful treatment option, its efficacy suffers from patient misalignment. Meaning, non-rigid changes in the patients posture or treatment area physiology can cause under-dosing of the tumor, and over-dosing of healthy tissue. This has largely been answered by computational algorithms, such as deformable image registration.

However, current strategies lack the ability to: create high resolution deformable biomechanical head and neck models from planning (pre-radiation therapy imaging) CT scans, simulate deformations that represent a range of inter-fraction patient posture changes and physiological regression and generate the subsequent CT images representing the deformed anatomy. The development of new and powerful algorithms to address these shortcomings may enhance the efficacy of radiation therapy in treating head and neck cancers.

INNOVATION

UCLA researchers led by Prof. Anand P. Santhanam have developed a novel physics-based high-resolution head and neck biomechanical modeling algorithm that addresses and alleviates the issues with current radiation therapy treatments. Their technology allows for real-time generation of CT images based on models from pretreatment imaging and adaptive simulations of non-rigid deformations/movements in the head and neck. This allows physicians to more appropriately irradiate the desired area with the correct and efficacious dose without damaging non-tumor healthy tissue. This will allow for adaptive radiotherapy applications. The model will be able to simulate changes in the patient anatomy and how the new treatment plan can be developed.

APPLICATIONS

- ▶ More efficacious radiation therapy for the treatment of head and neck cancers.
- ▶ Modeling related to 3D cartoon animation of the head and neck.

ADVANTAGES

- ▶ Currently the only technology to address issues and adapt to changes in patient biomechanical physiology for radiation therapy.
- ▶ Allows for a more controlled dose of radiation to target area while minimizing damage to healthy tissue.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,786,092	10/10/2017	2014-643

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INVENTORS

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OTHER INFORMATION

KEYWORDS

head and neck cancer, deformable image registration, image processing, 3D modeling, real time 3D modeling, biomechanical model, biomechanical imaging algorithm, CT, radiation therapy, adaptive radiation therapy, image registration, elastic model

CATEGORIZED AS

- ▶ **Biotechnology**
 - ▶ Health
- ▶ **Computer**
 - ▶ Other
 - ▶ Software
- ▶ **Imaging**
 - ▶ Medical
 - ▶ Other
 - ▶ Software
- ▶ **Medical**
 - ▶ Disease: Cancer
 - ▶ Imaging
 - ▶ Screening
 - ▶ Therapeutics

RELATED CASES

2014-643-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Systems and Methods for Real-Time Radiation Therapy Gantry Collision Detection](#)
- ▶ [Systems and Methods for Real-Time Remote 3D Radiotherapy Treatment Monitoring](#)
- ▶ [Systems And Methods For Real-Time Tracking Of Patient Anatomy Changes](#)

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