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MR-LINAC and CINE

A viewing platform for 4d medical images with extensive labeling functionality

Bachelorthesis Medical Informatics

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Abstract

MR guided radiotherapy has become a standard when treating cancer. The alternative to an operative removal of the tumor uses radiation, created by a linear accelerator (LINAC). MR-LINAC improves the accuracy of radiation by combining a LINAC with an MR imaging system. Magnetic resonance imaging (MRI) is optimal for viewing soft tissue such as most organs in the human body. It is also an important tool for detecting tumors in soft tissue such as the lungs and heart. The CINE MRI technology makes it possible to observe a slice through a patient over a period of time. This makes it easier to detect the margins of a structure and therefore decreases the risk of damaging tissue surrounding a tumor during treatment. To be able to use those technologies to their full extent, a viewing platform is needed.

Danksagung

Hier kommen die Danksagungen hin (falls gewünscht)!!!

Selbständigkeitserklärung

Hiermit erkläre ich, dass ich diese schriftliche Abschlussarbeit selbständig verfasst habe, keine anderen als die angegebenen Hilfsmittel und Quellen benutzt habe und alle wörtlich oder sinngemäß aus anderen Werken übernommenen Aussagen als solche gekennzeichnet habe.

Ort, Datum Unterschrift

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Chapter 1

Introduction

Viewing medical images on a light box is a thing of the past. In the digital age we're living in, tablets and monitors have taken over. With this change comes the need for new software. Mulitple applications for viewing X-Ray images, MR-scans, PET-scans etc. have already been developed. However, the digital world is evolving constantly and so existing applications need to be updated and improved. In the last few years Artificial Intelligence (AI) has made its way in to the medical field and is becoming more and more useful. These algorithms often work different as the human brain and so the outcome of the AI's calculations is usually the only useful information for the user. In cooporation with Marcel Früh, I have developed a simple App for viewing the work of a AI that has been trained to calculate the movement of a point in a CINE dataset.

Chapter 2

Medical Data and imaging

2.1 Image Aquisition

2.1.1 2d Slices

2.1.2 3d Volumetric imaging

2.1.3 4d medical imaging

4d medical imaging is the process of generating multiple 3d images over time. It is an advanced imaging method, used to study a patients movements and observe changes. The human body naturally moves at all times. Respiratory and cardiac motion, as well as digestion and muscle movements, cause the movement of surrounding tissues. It has always been a challenge to capture these movements in 3d medical images or get an image in a good position to see a certain feature. With 4d imaging, medical professionals are able to capture the whole movement and pick the best time frames for their issue.

2.2 image-guided therapy

2.2.1 planning

2.2.2 radiotherapy and LINAC

BlaBlaBla ...

Chapter 3

State of the art

Während im Grundlagenkapitel notwendige Begrifflichkeiten, Datenstrukturen, Basisalgorithmen oder Hardware-Architekturen vorgestellt werden, befasst sich dieser Abschnitt mit einer kurzen Diskussion existierender Ansätze und deren Probleme.

Je nach Themenstellung kann dieser Abschnitt auch entfallen. Eine kurze Diskussion kann in diesem Fall entweder in der Aufgabenstellung (Kapitel **??**) oder zu Beginn des eigenen Konzepts (Kapitel **??**) erfolgen.

Chapter 4

A viewing platform for 4d image data

4.1 Goal

The goal of this project, was to develop a viewing platform for MRI CINE data, which is easy to use and still provides useful editing and labeling tools. The focus was set on the labeling funcionality of the app. The user should be able to use the app intuitively without much explanation.

4.2 original approach

Chapter 5

Evaluation

BlaBlaBla

Chapter 6

Recapitulation and Future possibilities

BlaBlaBla

Bibliography

List of abbreviations

LINAC	Linear accelerator
MRI	Magnetic Resonance Imaging
PET	Positron emission tomography
CINE	...

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