# Develeopment of Analysis Techniques for dynamic magnetic resonance imaging

**– Master Thesis –**

to be awarded

Master of Science in Medical Photonics

submitted by

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## Abstract

Short summary of your thesis (max. 250 words) ...

## Acknowledgements

If you want to thank anyone (optional) ...

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FSU Jena  Friedrich-Schiller-Universität Jena

# 1 Introduction

Some of your text. Maybe with an acronym, such as Friedrich-Schiller-Universität Jena (FSU Jena).

## 1.1 Background and Rationale

Outline the importance of dynamic knee MRI and its applications in biomechanics.

## 1.2 Research Objectives

State the goal of developing new analysis techniques for dynamic MRI data.

## 1.3 Thesis Structure

Explain why this research is a logical next step following the development of the MRI knee loading device.

# 2 Literature Review

Review existing methods for analyzing dynamic knee MRI data.

## 2.1 Theoretical Framework

Foundational Theories: Start with the theoretical underpinnings that relate to MRI imaging and biomechanics of the knee. Biomechanical Models: Discuss any relevant biomechanical models or theories that apply to knee movement and loading.

## 2.2 Review of Related Work

Current Techniques: Within this subsection, critically analyze existing literature on analysis techniques for dynamic knee MRI. This is where you provide a detailed account of what has been done in the field. (Lundvall 1992) Comparative Analysis: Compare and contrast different approaches to illustrate the diversity in the field and to position your work in the context of existing research.

## 2.3 Research Gap

Limitations: Highlight the limitations in current methodologies as a way to show where the gaps in the literature exist. Explain how these limitations could affect the understanding or the application of the biomechanical data from knee MRI. Relevance to Biomechanics: Connect the limitations and gaps directly to their relevance in biomechanics, outlining why addressing these gaps is crucial for the field. This sets the stage for your research to be viewed as a necessary step forward.

# 3 Methodology

some text

## 3.1 Data Collection Methods

Data Collection Methods: Detail the specific techniques used to collect the MRI data, such as the types of knee movements, loading conditions, and the parameters set on the MRI machine. Sample Description: Describe the characteristics of your sample, such as the number of knees imaged, the population demographics, and any inclusion or exclusion criteria for your study.

## 3.2 Tools and Software

Software Utilization: Explain the use of software tools such as Python, including any libraries or frameworks that were particularly important for your analysis. Handling of Multi-dimensional Data: Describe the techniques employed to manage and analyze the multi-dimensional MRI data sets.

## 3.3 Data Analysis

Analytical Approach: Outline the methods used to process and analyze the MRI data. Include any specific software or custom algorithms developed for this purpose. Segmentation Techniques: Describe the semi-automatic segmentation process in detail, explaining how the different knee structures were identified and analyzed frame by frame.

### 3.4 Validity and Reliability

Validation Methods: Detail the steps taken to validate the segmentation techniques and the biomechanical parameters you derived. Reliability Measures: Describe any repeat analyses or cross-verifications done to ensure the consistency and reliability of your results.

# 4 Results

## 4.1 Segmentation

some text

## 4.2 Parameter Extraction

some text

# 5 Discussion

## 5.1 Technique Evaluation

Assess the effectiveness and accuracy of your segmentation techniques.

## 5.2 Biomechanical Insights

Discuss the biomechanical parameters obtained and their implications for understanding knee movement.

## 5.3 Comparison with Existing Methods

Compare your results with current analysis techniques.

# 6 Conclusion

## 6.1 Summary of Contributions

Recap the novel analysis techniques developed and their significance.

## 6.2 Limitations and Challenges

Discuss any limitations encountered and the challenges in the analysis process

## 6.3 Future Work

Suggest potential improvements and future directions for research

# References

Lundvall, B.-Å. 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning.* London: Pinter Publishers.

# A Appendix

If needed for supplementary material, such as detailed description of data collection, tables, or figures.

## Statutory Declaration:

I declare that I have developed and written the enclosed Master Thesis completely by myself, and have not used sources or means without declaration in the text. Any thoughts from others or literal quotations are clearly marked. The Master Thesis was not used in the same or in a similar version to achieve an academic grading or is being published elsewhere.

Place, Date

Signature