

T.C.

TURKISH-GERMAN UNIVERSITY

INSTITUTE OF THE GRADUATE STUDIES

IN SCIENCE AND ENGINEERING

THESIS TITLE

Master’s Thesis / Doctoral Thesis

Name SURNAME

ISTANBUL 2023



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Name SURNAME

B.Sc., Program Name, Turkish-German University, 2023

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Advisor

Prof. Dr. / Assoc. Prof. Dr. / Asst. Prof. Dr. Name SURNAME

Submitted to the Institute of the Graduate Studies in

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Master’s degree / degree of Doctor of Philosophy

ISTANBUL 2023

TITLE

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I would like to thank ……

DECLARATION OF AUTHENTICITY

I declare that I completed the … (master or PhD) thesis independently and used only the materials that are listed. All materials used, from published as well as unpublished sources, whether directly quoted or paraphrased, are duly reported. Furthermore, I declare that the master’s / doctoral thesis, or any abridgment of it, was not used for any other degree-seeking purpose and give the publication rights of the thesis to the Institute of the Graduate Studies in Science and Engineering, Turkish-German University.

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ABSTRACT

TITLE

The Abstract should consist of a single paragraph without any subtitles. It should not exceed one page. The related keywords (minimum 5 keywords) must be given below. References are to be avoided in the Abstract. The content of the Abstract should cover the background, problem to be solved, importance of the problem, aim, methodology, quantitative results, and conclusion.

**Keywords:** *Supervised Machine Learning; Lymphoma; Classification; Feature Selection; Gene Expression.*

ÖZET

BAŞLIK

Türkçe Özet, İngilizce yazılan özetin birebir karşılığı olmalıdır.

**Anahtar Sözcükler:** *Denetimli Makine Öğrenmesi; Lenfoma; Sınıflandırma; Öznitelik Seçimi; Gen Ekspresyonu.*

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LIST OF SYMBOLS

CLL/SLL Chronische lymphatische Leukämie/kleines lymphatisches Lymphom  
FL Follikuläres Lymphom  
HCL Haarzell-Leukämie

LIST OF ABBREVIATIONS

DTI Diffusion Tensor Imaging

WM White Matter

SOFM Self-Organizing Feature Mapping

SOFMAT Self-Organizing Feature MAp Tractography

DTT Diffusion Tensor Tractography

MRI Magnetic Resonance Imaging

NMR Nuclear Magnetic Resonance

PISTE Phantom Images for Simulating Tractography Errors

PCA Principal Component Analysis

1. INTRODUCTION

* 1. Background (literature review directly related with the content of the thesis)
  2. Problem and importance of the problem
  3. Aim and importance of the study
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2. MATERIALS AND METHODS / METHODOLOGY

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7. REFERENCES

[1] D. LeBihan, C. Poupon, A. Amadon, and F. Lethimonnier, ”Artifacts and pitfalls in diffusion MRI,” J. Magn. Res. Imaging, vol. 24, pp. 478-488, 2006.

[2] H. W. Chung, M. C. Chou, C. Y. Chen, ”Principles and limitations of computational algorithms in clinical diffusion tensor MR tractography,” AJNR Am. J. Neuroradiol., vol. 32, pp. 3-13, Jan 2011.

[3] D. Goksel-Duru and Mehmed ¨ Ozkan, ”Application of Self-Organizing ¨ Artificial Neural Networks on Simulated Diffusion Tensor Images,” Mathematical Problems in Engineering, vol. 2013, Article ID 690140, 13 pages, 2013. doi:10.1155/2013/690140.

[4] P.J. Basser, S. Pajevic, C. Pierpaoli, J. Duda, A. Aldroubi, ”In vivo fiber tractography using DT-MRI data,” Magnetic Resonance in Medicine, vol. 44, pp. 625-632, 2000.

[5] S. Haykin, Neural Networks: A comprehensive foundation. PrenticeHall, Inc., NJ, USA, 2005.

[6] T. Kohonen, Self-Organizing Maps, Springer, Berlin, 2001.

[7] S.C. Deoni and D.K. Jones, Generation of a common diffusion tensor imaging dataset, in Proceedings of the ISMRM workshop on methods for quantitative diffusion methods for quantitative diffusion MRI of human brain, 2005, <http://cubric.psych.cf.ac.uk/commondti>.