

Informatics and Technology Transfer: Bridging Innovation and Implementation

Editor: Dr. İsmail ÇETİN



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**INFORMATICS AND TECHNOLOGY TRANSFER:
BRIDGING INNOVATION AND IMPLEMENTATION**

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PREFACE

In today's rapidly changing world, the relationship between informatics and technology transfer plays a critical role in transforming innovative ideas into tangible solutions. Once thought to be exclusive to academic or research environments, innovation today requires a bridge to make it applicable to industries, businesses, and society.

This book, *Informatics and Technology Transfer: Bridging Innovation and Implementation*, aims to explore this important relationship by focusing on how knowledge, data, and technologies can be effectively transferred from the research world to real-world applications.

The transformation of an innovative idea into real-world impact is not a linear process. This process involves a series of stages, from conceptualization and validation to prototyping, testing, and ultimately scaling. Computer science and informatics play a crucial role in managing these stages more efficiently. Additionally, technology transfer mechanisms provide the necessary frameworks to ensure innovations reach the market and deliver economic benefits to society.

This book examines principles, strategies, and case studies that describe successful models of technology transfer, offering readers both theoretical and practical insights. It also highlights the challenges and opportunities in implementing new technologies.

As we navigate the complexities of the digital age, bridging the gap between innovation and implementation is more important than ever. This work aims to serve as a comprehensive guide for academics, students, and professionals looking to understand the intersection of informatics and technology transfer.

Dr. İsmail ÇETİN

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CHAPTER 1

OPEN SOURCE LINEAR PROGRAMMING LIBRARIES AND THEIR USE IN AGRICULTURAL OPTIMIZATION

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ABSTRACT

Nowadays, open source linear programming libraries offer powerful tools for farmers and researchers who want to increase efficiency and manage resources effectively in decision-making processes in the agricultural sector. This paper reviews open source linear programming (LP) libraries used in agricultural optimization applications. Within the scope of the study, PuLP, GNU Linear Programming Kit, OR-Tools and SciPy libraries, which are the most prominent open source linear programming libraries in linear programming, were examined.

This study examines the application of linear programming principles in agricultural optimization, beginning with a brief overview of its fundamental concepts. The discussion elaborates on how these libraries address various challenges encountered in agriculture, exemplified through applications in agricultural productivity, resource management, production planning, inventory management, marketing, and distribution.

Furthermore, the paper provides a detailed analysis of how open-source linear programming libraries contribute to agricultural optimization efforts. It discusses the unique features and advantages of selected open-source platforms, supported by practical examples illustrating their application in solving agricultural optimization problems. By outlining solution strategies derived from these applications, the paper aims to serve as a valuable resource for researchers, farmers, and software developers seeking to enhance productivity and promote sustainable practices in agriculture.

Keywords: Linear programming, Agricultural optimization, Open source libraries, GLPK

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1. INTRODUCTION

With the advancement of technology, agricultural operations are managed with the use of algorithms. This requires the development of effective strategies in areas such as agricultural operations planning, resource allocation, production optimization and logistics management. Mathematical optimization techniques, especially linear programming, offer powerful tools that can solve efficiency and sustainability problems in the agricultural sector.

In this context, open source linear programming libraries have attracted attention as an important part of agricultural optimization. These libraries are publicly available software libraries that can be used in various aspects of agricultural operations. The focus of the study is to investigate the potential applications and advantages of these libraries in agricultural optimization.

2. LINEAR PROGRAMMING

Linear Programming (LP) is a collection of concepts and methods related to linear decision models. LP involves optimizing a linear objective function to achieve the optimal value, subject to linear equality and/or inequality constraints. The goal is to maximize or minimize this objective function while adhering to the specified linear constraints. It is also defined as an appropriate decision-making method under conditions whose details are known.

LP enables the optimization of a linear objective function involving numerous variables, while adhering to linear equality and inequality constraints. The solution to this mathematical framework can be construed as a plan, detailing the allocation and timing of actions necessary for the system to progress from a defined initial state towards a specific objective [1].

LP is an important discipline of applied mathematics that solves various optimization problems. It is commonly used in scheduling and production planning problems. The main advantage of linear programming as an optimization method is that it always arrives at the optimal solution, if any [2].

Solving a linear programming problem is basically finding the values of all structural and auxiliary variables. The solution values satisfy the following conditions:

- satisfy all linear constraints
- within its own borders
- provides the smallest (in the minimization case) or the largest (in the maximization case) value of the objective function [3].