3-Dimensional Knapsack problems

BCS 36

Angelos Vasilikiotis
Etienne Huijdts
Luigelo Davila
Stylliani Mikeli
Greg Vadasz

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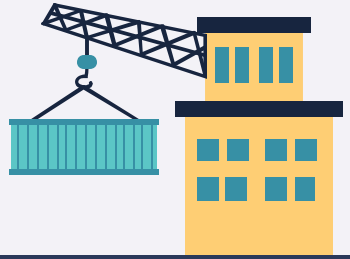
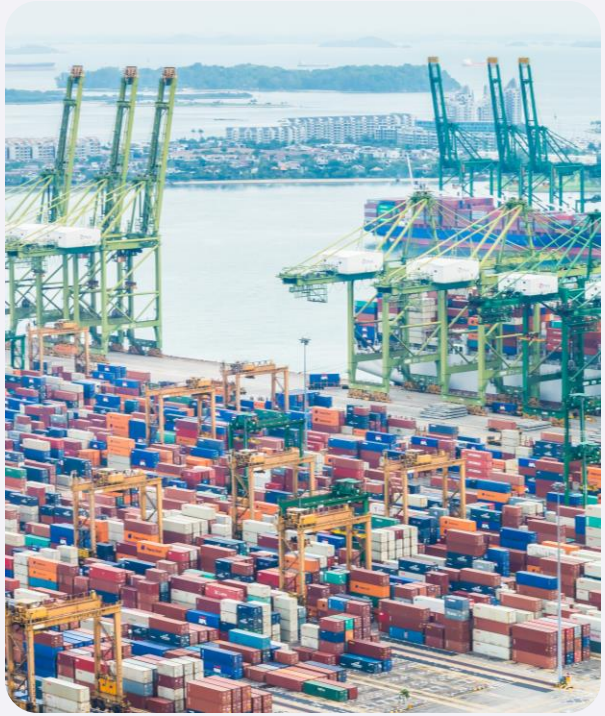


01

Introduction

Exploring the 3D Knapsack Challenge



02 Problem Statement

Objective
- Maximize Value by efficiently packing parcels

Features
- 3D visualization
- User-friendly interface

Investigation
- Full Cargo Utilization
- Maximum Parcel Value

Adaptation
- Handling three pentomino-shaped parcels (P, L, T).

Further Inquiries
- Full Pentominoes Cargo Utilization
- Maximum Pentominoes Value

Validation
- Code implementation

03 Algorithm Overview

03 Backtrack Algorithm

Objective
- Efficient 3D Parcel Packing.

Approach
- Use backtracking for optimal position & rotations

Constraints
- Full cargo-space
- Introducing holes

Process
- Continuously exploration and backtracking.

Goal
- Fill cargo space

Outcome
- Optimal arrangement of parcels

Implementation
- Recursion
- Rotations for efficiency

03 Genetic Algorithm

Initialize Population

Setup Parcel, order and score.

Crossover

Select two parents from top 50% for uniform crossover.

Evaluation

Assess new population's fitness.

Selection

Sort population by score. Use elitism.

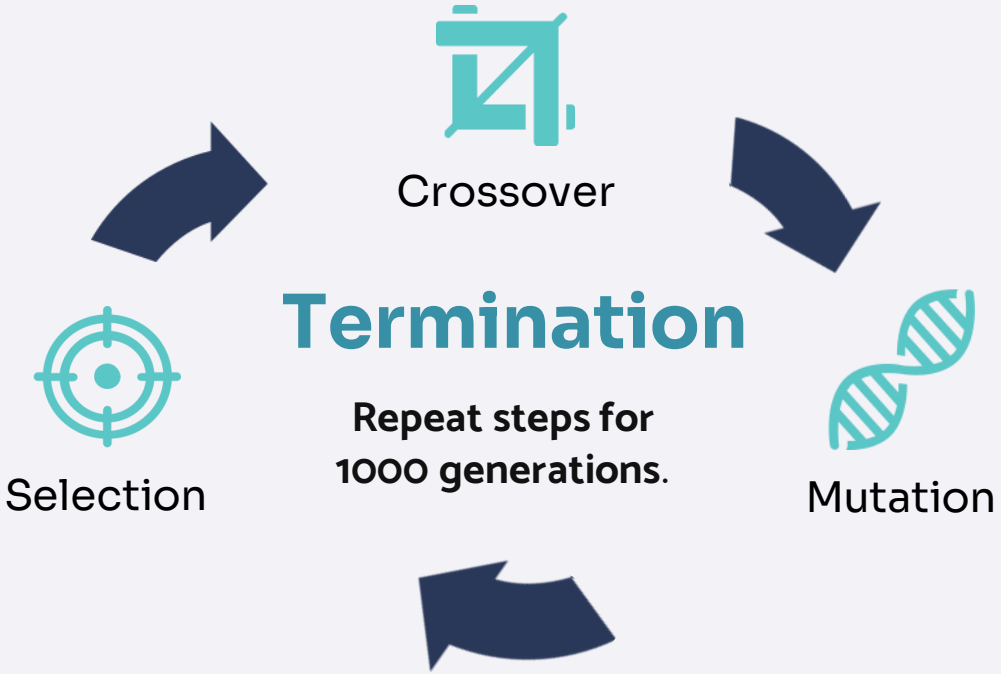
Mutation

Make small random changes for diversity.

Plateau

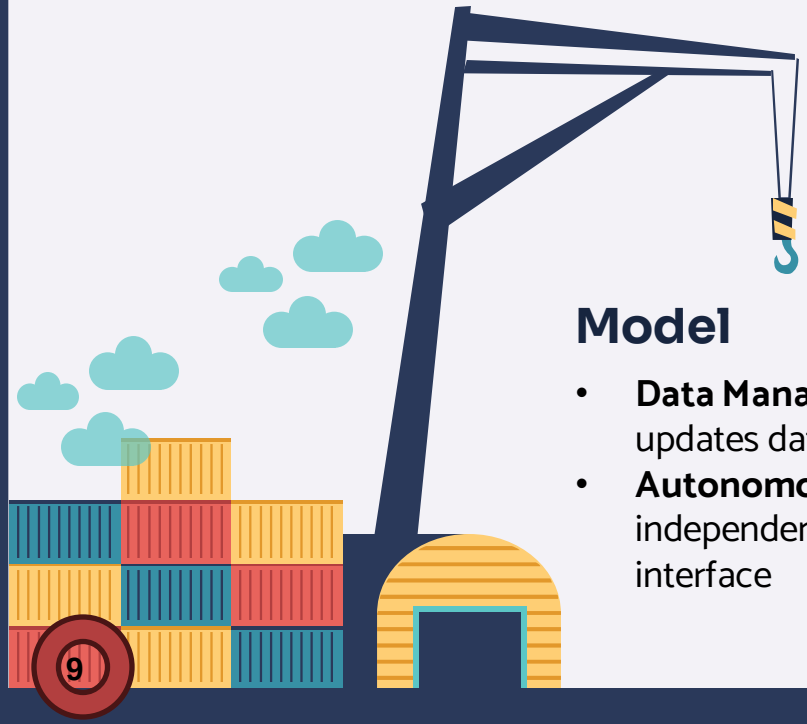
If reached, reset majority of population using elitism.

03 Genetic Algorithm



04 Implementation

Model View Controller (MVC)



Model

- **Data Manager:** Handles and updates data.
- **Autonomous**: Works independent of the user interface

View

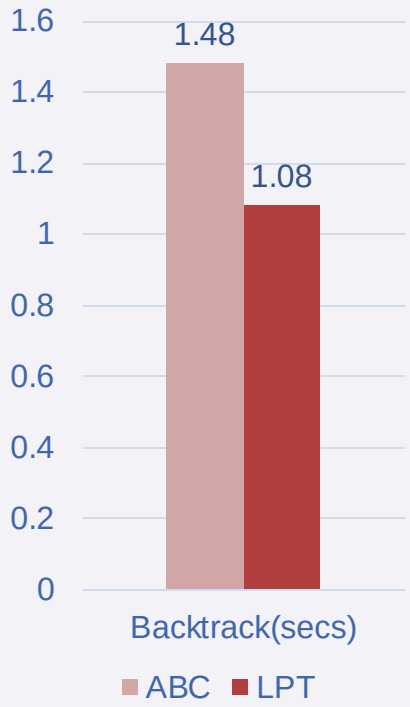
- **Data Display:** Showcases data to the user.
- **Interface Presenter**: Manages user interface

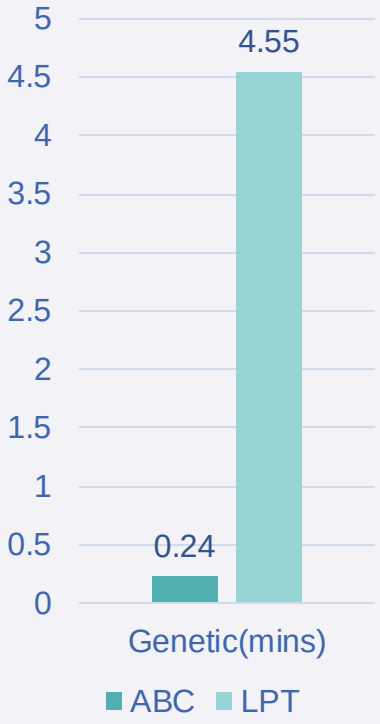
Controller

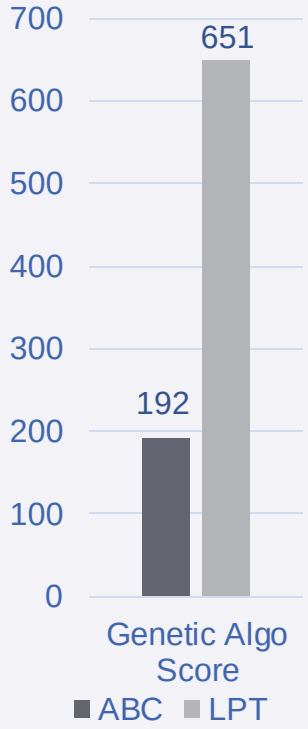
- **The Bridge:** Connects Model & View.
- **User Input Handler**: Processes user input and updates Model and View

04 DEMONSTRATION

05 Performance



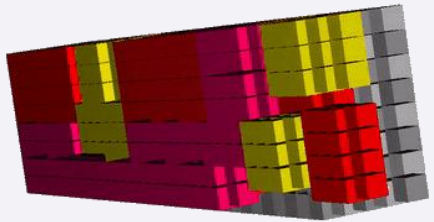




06

Parcels Result

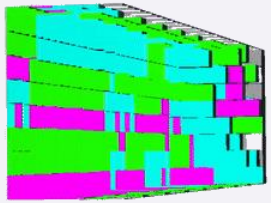
Fill Cargo Space with A, B or C parcels without gaps?



Parcel A Parcel B Parcel C

06

Pentominoes Result



Can the cargo space be fully packed with L, P, and/or T pentominoes without gaps?

P Pentomino L Pentomino T Pentomino

06 Conclusion

	Description	Answer / Result
Question A	Fill cargo space with **A, B, or C parcels**, no gaps?	**No**
Question B	Max value for **A, B, C parcels** (3, 4, 5 units) in cargo space?	**192**
Question C	Can the cargo space be fully packed with L, P, and/or T pentominoes without gaps?	**No**
Question D	Max value for L, P, T pentominoes (3, 4, 5 units) in cargo space?	**651**

07 Future Enhancements

Heuristic Approach

Study unimplemented advanced strategies like simulated annealing.

Hybrid Optimization

Investigate combining genetic algorithms and local search for performance boost.

Deep Learning

Consider future implementation for heuristic improvement

Parallelization Examination

Examine parallelization to enhance scalability for larger problem instances

Dynamic Adaptation

Develop dynamic adjustments for diverse problem scenario.

Resources Optimization

Optimize CPU usage for improved efficiency.

08 Who DID What

	Angelos	Etienne	Greg	Luigelo	Styliany
GUI & Architecture	10%	10%	-	80%	-
Backtrack	10%	-	-	-	90%
Genetic Algorithm	5%	-	85%	10%	-
Heuristics	15%	15%	-	-	70%
Knapsack	10%	10%	-	10%	70%
Presentation	60%	10%	5%	25%	
Report	-	5%	95%	-	-

Thanks!

Any questions?

Interact with us