

# Hector Analysis CEC 2024 Programming

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# Preface

1. Problem Statement & Assignment
2. Requirements



# Preface - Problem Statement

1. Problem Statement
  - A small startup hired by WANBIS Corp. to create an interface of resource acquisition to plan to the government of F.I.N
2. Assignment
  - To provide a continuous path for up to two drilling rigs from the given dataset and choose the best course of action.



# Preface - Requirements

## 1. Requirements

- Rigs cannot be on land or pass over it
- Rigs must be a minimum of two units away from each other at all times
- Can move 5 units max between days

## 2. Personal Requirements

- Create a user-friendly interface, defining a path for both rigs that maximizes obtainable resources, while minimizing the impact on preserved resources.



# Abstract

1. Our Motivation
2. Our High Level Solution

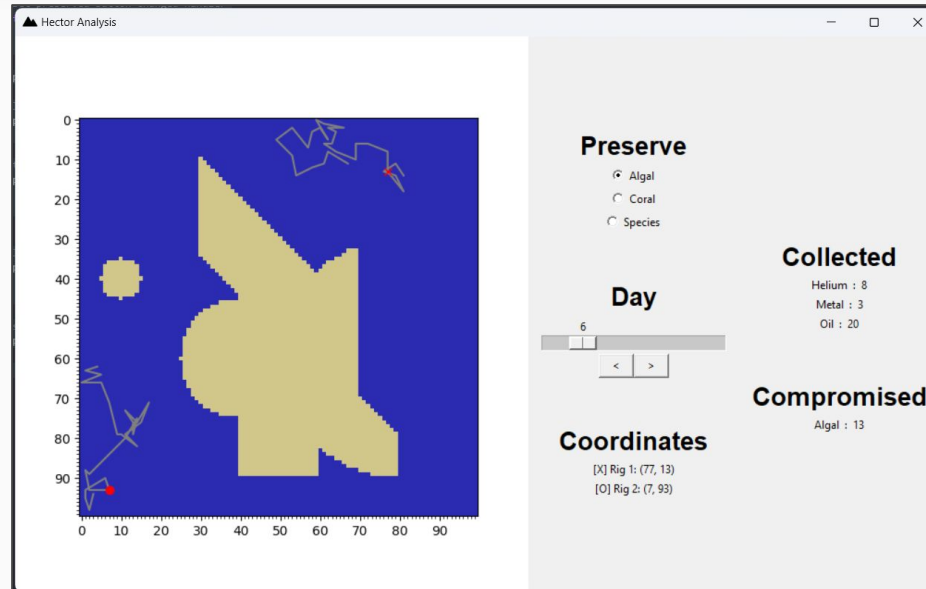


# Abstract - Motivation

1. Motivation
  - Easy to use and understand for non technical users
  - Scalability for future
  - Generates a good solution



# Abstract - High Level Solution



# Abstract - High Level Solution

**Preserve**

- ☒ Algal
- ☐ Coral
- ☐ Species

**Day**

4

< >

**Coordinates**

[X] Rig 1: (4, 4)

[O] Rig 2: (50, 4)

**Collected**

Helium : 4

Metal : 14

Oil : 24

**Compromised**

Algal : 34





# Technicalities

1. Technologies Used
2. File Interpretation
3. Algorithm
4. User Interface



# Technicalities - Technologies Used

## 1. Technologies Used

- Python (Easy use case within short time frame for data processing, and UI creation)

## 2. Packages

- NumPY, Matplotlib, Internal Imports



# Technicalities - File Interpretation

1. CSV, NumPY, and os packages
  - For data processing within a short time frame, NumPY was our choice
  - Internal os, and CSV for interaction between NumPY and raw CSV
2. Main Premise and Output
  - To process all 30 days for a given dataset, normalize the valid values and pass to the algorithm



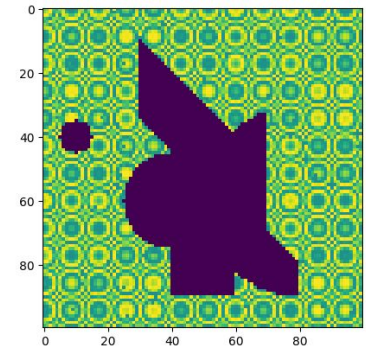
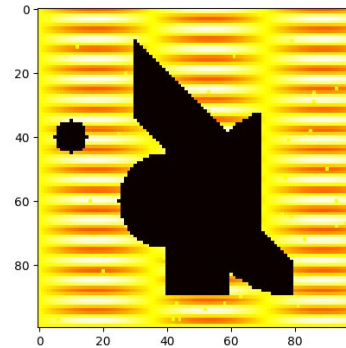
# Technicalities - File Interpretation

- Files used
  - All Obtain files
  - All preservation files (1 used per run)
  - World array data



# Technicalities - File Interpretation

1. Examples of Heatmaps for Normalized Values
  - **Left:** Algal Day 14
  - **Right:** Species Day 14
2. Land as improper -1 value with values from (0...1)



# Technicalities - Algorithm

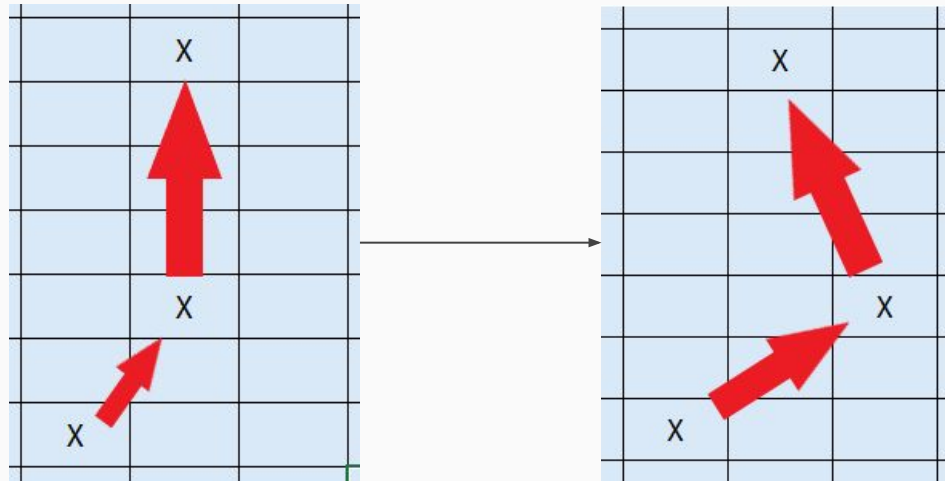
## 1. Genetic Algorithm

- Randomized Individuals
- Mutations
- Child Creation
- Fitness



# Technicalities - Algorithm

- Mutations



# Technicalities - Algorithm

- Child Creation

Parent: [Rig 1 Path, Rig 2 Path]

Parent: [Rig 1 Path, Rig 2 Path]

Child: [Rig 1 Path, Rig 1 Path]

Child: [Rig 1 Path, Rig 2 Path]

Child: [Rig 2 Path, Rig 1 Path]

Child: [Rig 2 Path, Rig 2 Path]

Child: [Rig 1 Path, Rig 2 Path]

Child: [Rig 1 Path, Rig 2 Path]





# Technicalities - Algorithm

- Fitness

$$\text{Fitness\_Value} = \text{oil} + \text{metal} + \text{hydrogen} - (3 * \text{preserved\_material})$$

All these are normalized values



# Future Outlook

1. Future Outlook - File Interpretation
  - a. Cloud Computing for webapp implementation
  - b. Package Considerations
2. Future Outlook - User Interface
  - a. Update user interface (html)
  - b. More map functionality (zooming, more map information)
3. Future Outlook - Algorithm Considerations
  - a. Greedy Algorithm for Movement
  - b. Improved Crossover during Child Creation



# Future Outlook - File Interpretation

## 1. Future Design

- Either use of a cloud computing platform for online format, could be a webapp, or interactable program.
- Primary design meant for scalability, and quick processing times

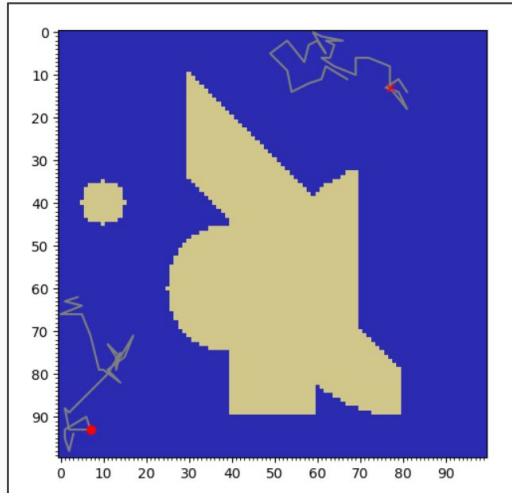
## 2. Considerations

- More temporary solution as well could be Pandas package with a debugging unit interface for data testing and sets.



# Future Outlook - User Interface

1. Update user interface with html (versatile)
2. Update map interface (coordinate tracking, more information)



# Future Outlook - Algorithm Considerations

## 1. Greedy Algorithm for Movement

- a. Determining a valid movement follows an incomplete greedy algorithm
- b. It is very likely that the search will choose short term improvement, sacrificing finding a valid solution
- c. Considering alternative AI pathfinding approaches would be beneficial



# Future Outlook - Algorithm Considerations

## 1. Improved Crossover During Child Creation

- a. At the moment, the crossover does not encourage genetic diversity
- b. Considering a more advanced, specific use-case crossover operation would improve genetic diversity



# Thank you!

We will now demonstrate our code.

