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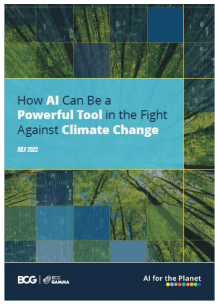
Optimization

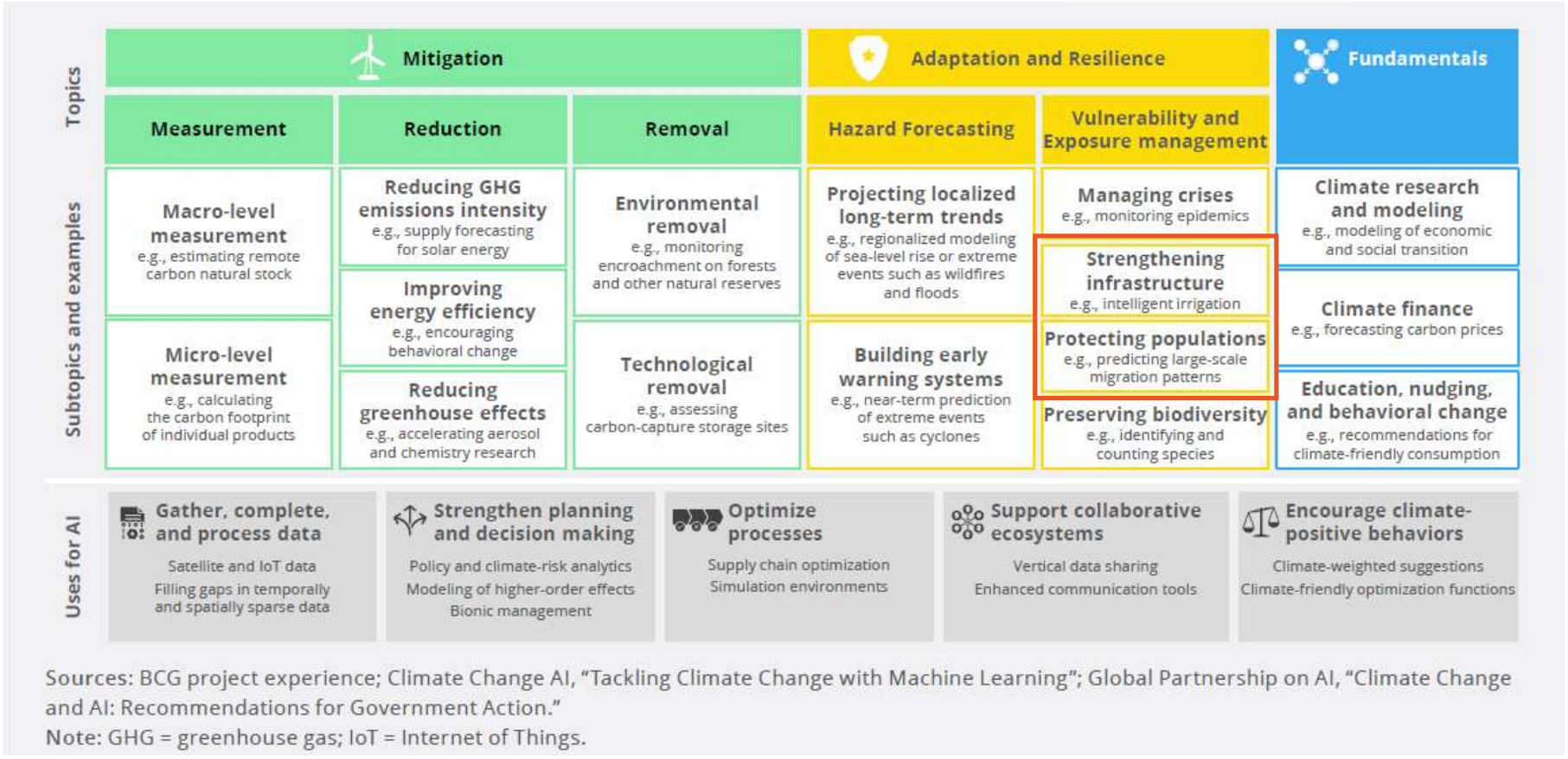
EMINES - 2023

abs.um6p.ma

Final project
Operations Research for Climate Change

AI for the planet





Sources: BCG project experience; Climate Change AI, "Tackling Climate Change with Machine Learning"; Global Partnership on AI, "Climate Change and AI: Recommendations for Government Action."
Note: GHG = greenhouse gas; IoT = Internet of Things.

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« Protecting over sea level rise » : context

As we all know

Climate change has reached a certain irreversible levels on many different aspects, one of these aspects is the sea level rise. This phenomenon induces high risks to damage properties and vital assets that could easily be affected if they come in contact with water.

However, changing the locations of these assets can be a very costly process both in terms of time and finances and other aspects depending on the type of assets they can be.

Key question

How to protect these assets ?

Key question

The decision was made to put barriers/walls to protect the assets.

But how to set these barriers in an effective manner that allows to protect the assets while minimizing the the overall costs ?

That's our optimization question.

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Problem statement

Land elevation data

Matrix of land elevation of each region and a sea elevation rate as well as the locations of each asset we are to protect.

9	8	2	5	7
10	3	9	0	8
3	6	2	6	5
6	2	3	5	7
5	8	1	7	2

In red, the location of the assets.

With a sea elevation = 5

Region in danger of flooding

9	8	2	5	7
10	3	9	0	8
3	6	2	6	5
6	2	3	5	7
5	8	1	7	2

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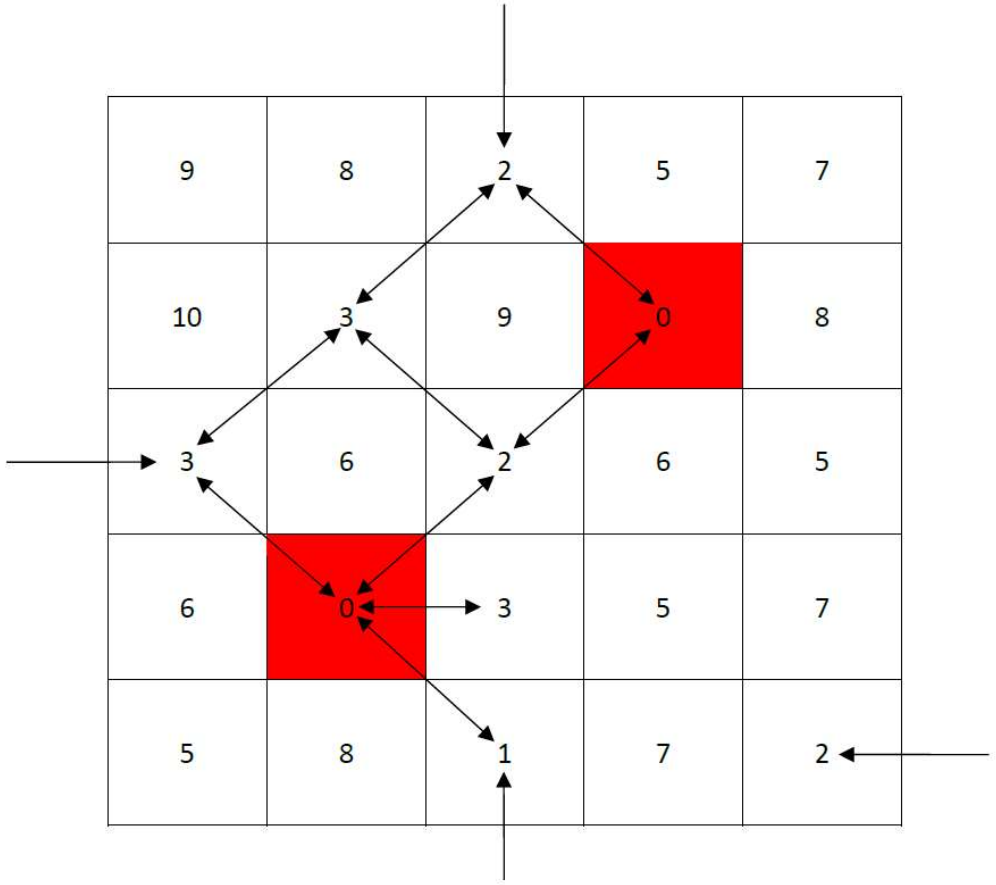
Finding all the paths from where water can pass from



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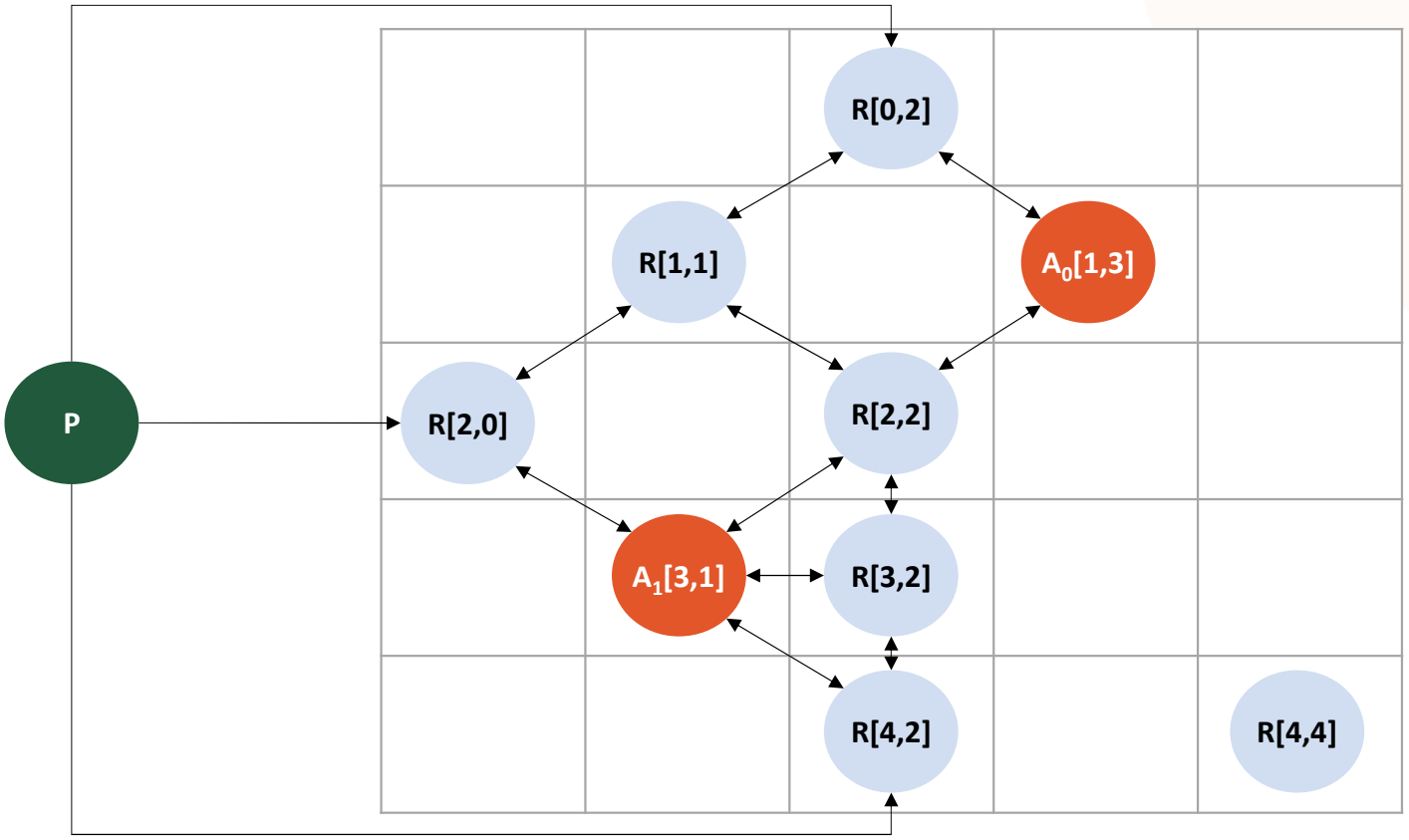
Formulate these paths as graphs



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Then optimize over this graph

To each edge is associated a cost

$$Cost_{R1->R2} = slr - land\_elevation_{R2}$$

Optimization

What is the cheapest set of edges to remove in order to protect the assets ?

Graph processing

How could you process your graph in order to reduce the complexity ?

What is expected from you ?

- **Solve with a MIP for small instances.**
- **Then use a meta-heuristics for adressing big instances**

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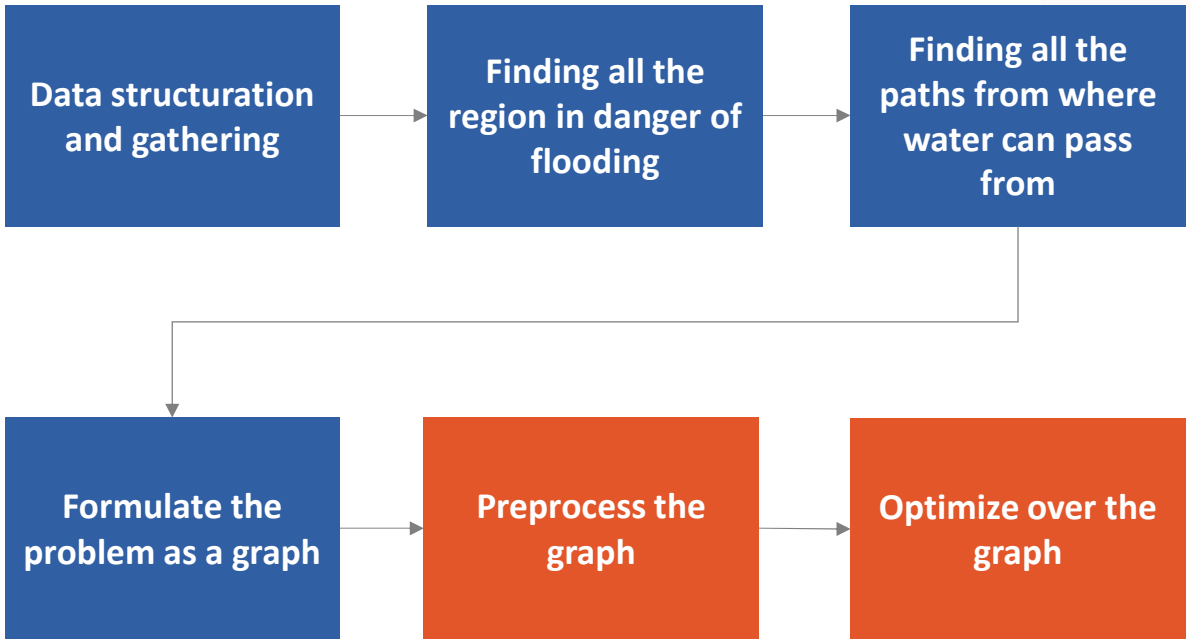
Project overview : the major steps



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