

# **A Two-Stage Redistricting-Location Problem in Emergency Evacuation Planning**

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## **Abstract**

We present a two-stage redistricting-location problem in the context of emergency evacuation planning. The first stage is a multi-objective fair redistricting problem re-evaluating the pre-existing district assignments to optimize the prioritization of equitable population distribution and hazard risks mitigation while ensuring spatial adjacency and compactness. The optimal re-districting solution enters the second stage as a parameter for the facility location-allocation problem, which yields the optimal location of short- and long-term evacuation centers and allocation of districts to chosen facilities. A real-world case from Cagayan de Oro City in the Philippines is considered. Numerical results demonstrate that the solution approach significantly improved the emergency response of the local government during Super Typhoon Rai, the second most destructive typhoon in the Philippines.

## **Keywords**

Fair Redistricting, Facility Location Problems, Humanitarian Logistics, Fairness

## **Biographies**

**Johannie Mae Uy** is a final year Industrial Engineering student at Xavier University - Ateneo de Cagayan in the Philippines. Her research interests include operations research, data science, data engineering, disaster resilience, and humanitarian logistics.

**Shelley Anne Gail Cagaanan** is an undergraduate student from BS in Industrial Engineering at Xavier University - Ateneo de Cagayan. She is mostly inclined with research topics on data science, data analytics, optimization, and lean manufacturing. Other interests outside research includes exploring digitalization initiatives for manufacturing such as PowerBI, and digital and software development.

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