Title: Multi-Purpose Planner

Invention: A multivariate optimization framework using stochastic optimization algorithms for planning applications. These algorithms perform model inversions and work with 3D data. This framework provides planning solutions for a variety of applications including surgical procedures, logistics, and transportation.

Background: When computational models and simulations are run, various inputs are given to the system. The system then returns the model’s predicted outcome. While these models can be refined to give very accurate predictions, it can be a challenge to run these models in reverse, or invert them. To invert a model today, a user would typically need to manually try various inputs and verify if the desired outcome is still achieved. Ideally, a user would only need to enter a desired outcome, and have the system give back the inputs that would be required to achieve this outcome.

Running a model backwards can have significant benefits. If there is a specific outcome desired, an inversion of the model can produce the optimal inputs required. For example, if a vehicle needs to reach a specific destination, the optimal path of least resistance can be calculated. While algorithms exist to solve these types of problems in 2D space, such as Dijkstra, traveling salesman problem, and A*, there are relatively few that can solve 3D problems, encompassing terrain types and altitudes.

Advantages:

- Allows existing models and simulations to be inverted
- Provides best and worst case scenarios
- Designed to be compatible with 3D data
- Scales easily and efficiently

Applications:

- Surgical procedure planning specifically designed for each patient, including robotic surgery.
- Planning tool for systems containing GIS-data (Geographic Information System), including infrastructure planning (e.g. urban planning) and the forestry industry.
- Route planning for travel and transportation logistics (e.g. package delivery companies, airline industry).
- Electric circuit or chip design.
- Reversing computational biomedical models such as protein studies.

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