

## ABSTRAK

Peziarahan ke Goa Maria di Daerah Istimewa Yogyakarta (DIY) semakin diminati oleh umat Katolik, namun penentuan rute kunjungan yang efisien ke beberapa lokasi sekaligus masih menjadi tantangan. Permasalahan ini dimodelkan sebagai *Travelling Salesman Problem* (TSP), yaitu pencarian rute terpendek yang mengunjungi seluruh lokasi tepat satu kali dan kembali ke titik awal. Penelitian ini bertujuan menerapkan metode hibrida Algoritma Genetika (AG) dan *Ant Colony Optimization* (ACO) untuk menentukan rute terpendek kunjungan ke 10 Goa Maria di DIY. Pada metode ini, ACO membentuk solusi awal berdasarkan mekanisme jejak feromon, yang kemudian disempurnakan melalui proses evolusi AG (seleksi, *crossover*, dan mutasi) guna menghindari solusi optimum lokal. Hasil pengujian menunjukkan metode hibrida AG-ACO menghasilkan rute terpendek sejauh 230 km, setara dengan hasil AG murni (230 km) dan lebih baik dibandingkan ACO murni (242 km).

**Kata kunci:** Goa Maria, Algoritma Genetika, *Ant Colony Optimization*, *Travelling Salesman Problem*, optimasi rute

## ABSTRACT

*Pilgrimages to the Marian Caves in the Special Region of Yogyakarta (DIY) are increasingly popular among Catholics, but determining efficient routes to visit multiple locations simultaneously remains a challenge. This problem is modeled as the Traveling Salesman Problem (TSP), which is finding the shortest route that visits all locations exactly once and returns to the starting point. This study aims to apply a hybrid method of Genetic Algorithm (GA) and Ant Colony Optimization (ACO) to determine the shortest routes to visit 10 Marian Caves in DIY. In this method, ACO forms an initial solution based on the pheromone trail mechanism, which is then refined through the AG evolution process (selection, crossover, and mutation) to avoid local optimum solutions. The test results show that the AG-ACO hybrid method produces a shortest route of 230 km, equivalent to the results of pure AG (230 km) and better than pure ACO (242 km).*

**Keywords:** *Maria Cave, Genetic Algorithm, Ant Colony Optimization, Traveling Salesman Problem, route optimization*