Traffic Congestion Reduction Using Ant Colony Optimization

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Traffic congestion is a problem that plagues most metropolitan areas. The problem has grown worse over the years as more people seek to reside in suburban areas and commute to work. Increased affordability of cars and limited road space exacerbate the problem. Several different options are available to city planners to reduce traffic congestion. These include tolls and taxes, increased parking fees, staggered work times, carpooling, use of public transport, telecommuting, among others. This paper looks at the use of carpooling and buses to alleviate traffic congestion. By varying the extent of carpooling and number of buses, the impact on commute time, total fuel consumed, and CO2 emissions can be studied. Since these objectives do not always work together, it becomes necessary to derive a combining function that will weight the different objectives. Given that there are many combinations of carpooling and number of buses that can be deployed at different times during of the traffic congestion period, selecting the best combination can become computationally intractable. This paper uses an evolutional programming approach to search through that problem space to quickly identify promising solutions. It uses an ant colony optimization (ACO) approach. Using data on traffic flow on select freeways in southeastern Wisconsin, a model for estimating commute times and fuel consumption is assembled. Results indicate that the ant colony optimization approach yields good solutions when applied to a problem of determining the preferred extent of carpooling and the number of buses to be run at different times during the weekday morning rush period.