Korean researchers combine algorithm with wireless communication to reduce traffic jams

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(PhysOrg.com) -- Hyun Keun Lee and Beom Jun Kim, researchers at the University of Seoul, have developed an idea on how to reduce traffic jams or in some cases prevent them all together. In their paper, published in *Physica A: Statistical Mechanics and its Applications*, they suggest outfitting every vehicle on the road with wireless communications, some on-board controls, and the implementation of a simple algorithm.

Their idea is based on research that has shown that traffic jams occur when (quite obviously) cars are pouring faster into an area of road than the speed at which they are leaving; this results to some extent, the researchers say because of differences in drivers. They say that there are two kinds of drivers on the road. The first are “optimistic” who believe that driving more aggressively will get them to their destination faster. They tend to be the ones to move closer to the vehicle in front of them than is generally deemed safe. The second group, comprised of “defensive” drivers tend to fear the actions of other drivers and as a result tend to put more space between their vehicle and the one they are following. Not surprisingly, the researchers suggest that it’s the optimistic drivers who contribute more to traffic jams because they are the ones that cause the bunching.

To build their algorithm, the team used these bits of information. To put an end to a traffic jam, they reason, all that’s needed is for cars that are

headed for the jam to slow down and for those that are leaving the jam to speed up. The problem is, people on their own don't follow these rules. Thus, they suggest that each car be fitted with controls that can force a car to slow down or speed up when deemed necessary, and with wireless technology so that all the cars in the area can "talk" to each other. In such a system, all of the cars on the road could be made to be of the defensive type as well, thus alleviating the original cause of so many jams.

In such a real world system, all of the cars and trucks on the road would broadcast their location and speed to all other vehicles in the area. When an onboard control system for an individual vehicle notes that the cars ahead seem to be slowing down for no apparent reason, it would slow the vehicle right away, preventing things ahead from getting worse. If every car heading into the jam did the same, the problem would be reduced. At the same time, those cars on the other side of the jam would be sped up automatically so as to relieve the pressure of the jam. Such a system would not require a central computer controlling everything; each car would react as it should based on the same algorithm in its own individual controller.

Realistically, it does appear that such a system would work. The only problem of course would be getting all of the cars on the road fitted with such controls, especially the part where they driver wouldn't be allowed to override them as is the case with virtually all other automated controls currently being implemented in vehicles.

More information: Dissolution of traffic jam via additional local interactions, *Physica A: Statistical Mechanics and its Applications*, Volume 390, Issues 23-24, 1 November 2011, Pages 4555-4561. Preprint available: arxiv.org/abs/1109.2191

Abstract

We use a cellular automata approach to numerically investigate traffic flow patterns on a single lane. The free-flow phase (F), the synchronized phase (S), and the jam phase (J) are observed and the transitions among them are studied as the vehicular density ρ is slowly varied. If ρ is decreased from well inside the J phase, the flux Φ follows the lower branch of the hysteresis loop, implying that the adiabatic decrease of ρ is not an efficient way to put the system back into S or F phases. We propose a simple way to help the system to escape out of J phase, which is based on the local information of the velocities of downstream vehicles.

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