Intelligent Traffic System Predicts Future Traffic Flow on Multiple Roads

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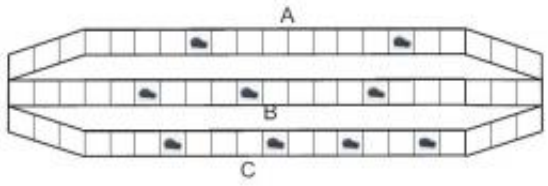

In the three-route system, information on a display board lets drivers know the predicted future congestion of each of the three roads, helping drivers choose the fastest route. Image credit: Dong, et al.

(PhysOrg.com) -- In urban areas, there's almost always more than one way to get somewhere, but often it's difficult to predict which road will be fastest. In an attempt to improve traffic flow and decrease congestion, researchers have been developing intelligent traffic systems that display real-time information about various roads on a display board, helping drivers make the best road choice. Until now, this information has always displayed traffic conditions from the immediate past. A new system can now predict future traffic conditions based on real-time data, giving drivers more relevant information to choose the fastest route.

The researchers, Chuanfei Dong, *et al*, from the Georgia Institute of Technology, the University of Science and Technology of China, Syracuse University, and the University of Shanghai for Science and Technology, have recently reported the results of their new intelligent

traffic system, called the prediction feedback strategy (PFS). In simulations, the researchers demonstrated that PFS could control traffic flow better than three other information feedback strategies. Even if only some drivers choose to use the information, the improved strategy could help to alleviate traffic congestion and enhance the capacity of existing infrastructure.

“The greatest significance of our work is that PFS can predict the future situation of roads, so then we can know what will happen and how to prevent congestion in the future,” Dong told *PhysOrg.com*.

While intelligent traffic feedback strategies have almost always been applied to two-route systems, in this study the researchers investigated how the strategies performed in a more complex three-route scenario. In this model, drivers choose one of three routes according to real-time information feedback. The researchers then performed simulations with strategies based on previous vehicles’ overall travel times (determined at the end of the route), the average velocity of vehicles (determined at various steps of the route), or congestion of each route, which is calculated by vehicles sending their location using GPS to a control center (determined at various steps of the route). Out of these three strategies, the last one that calculates congestion has shown to be most efficient.

The researchers’ new strategy, PFS, takes the congestion information from the previous strategy, but then takes another step by predicting the road situation in the future based on the current road situation. By predicting the future, PFS can overcome a lag effect that hinders the other strategies. This advantage enables PFS to accommodate an increased vehicle capacity compared to the other strategies. Although the average vehicle speed is slightly slower using PFS (since more vehicles mean lower speed), the flux (which measures a combination of average velocity and vehicle density) is largest using PFS.

"In [the previous strategies], the travel time reported by a driver at the end of two routes only represents the road condition in front of him, but perhaps the vehicles behind him have gotten into the jammed state," Dong explained. "Unfortunately, this information will induce more vehicles to choose his route until a vehicle from the jammed cluster leaves the system. This effect apparently does harm to the system. On the other hand, PFS can predict the future situation of the road and the effects to the route situation caused by the traffic jam at the end of the traffic system; therefore, the new strategy may improve the road situation."

More information:

• Dong Chuan-Fei, Ma Xu, Wang Bing-Hong, and Sun Xiao-Yan. "Effects of Prediction Feedback on Multi-Route Intelligent Traffic Systems." arXiv:0909.5202v2

• Prediction feedback in intelligent traffic systems, *Physica A: Statistical Mechanics and its Applications*, Volume 388, Issue 21, 1 November 2009, Pages 4651-4657, doi:10.1016/j.physa.2009.07.018