Diagnostic Accuracy Under Congestion

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Abstract

In diagnostic services, agents typically need to weigh the benefit of running an additional test and improving the accuracy of diagnosis against the cost of congestion, i.e., delaying the provision of services to others. Our paper analyzes how to dynamically manage this accuracy/congestion tradeoff. To that end, we study an elementary congested service facing an arriving stream of customers. The diagnostic process consists of a search problem in which the agent conducts a sequence of imperfect tests to determine whether a customer is of a given type. Our analysis yields counter-intuitive insights into managing diagnostic services. First, we find that the maximum number of customers allowed in the system should initially increase with the number of performed tests. This result is in sharp contrast to the established literature on value/congestion tradeoffs, which consistently asserts that congestion levels should decrease with service times. Second, we find that the agent should sometimes diagnose the customer as being the positive type, even when all tests are negative. Finally, our numerical study shows that our counter-intuitive findings can have a significant impact on system performance.

Biography

Peng Sun is an Associate Professor of Decision Science at the Fuqua School of Business, Duke University. He obtained his PhD degree in Operations Research from MIT in 2003.