Joint Condensed Matter
and
Center for Soft Matter and Biological Physics
Seminar

Xiangwen Wang

Dept. of Physics, Virginia Tech

Data-driven modeling of heavy-tailed distributions and scaling laws in human dynamics

Monday, March 26, 2018

4:00pm – 5:00pm

304 Robeson Hall

Studying human behavior is of fundamental importance in many social applications. Yet, it remains a challenging problem due to the high complexity of human activities. In recent years, advances in information technology have resulted in the collection of vast amounts of human activity logs, thus enabling the quantitative modeling of human behavior. Using a variety of metrics like probability distributions, we prove the wide existence of heavy-tailed distributions and scaling laws in human behavior. In human online searches we describe the search behavior as a foraging process that takes place on the semi-infinite line. A pairwise power-law distribution respectively exponential distribution is reported for step-lengths in long-range respectively short-range displacements, indicating that the search process is a combination of Brownian-motion local phases and truncated-Levy-flight relocation phases. These results are confirmed through the analysis of mean squared displacements. In human online gambling, we view the net change of income of each player as a random walk and find that the win/loss distributions follow power laws with exponential cut-offs. The mean squared displacement of these net income random walks exhibits a transition between a super-diffusive and a diffusive regime. We present a model that allows to reproduce this behavior and identify the key features needed for observing this transition. For human movements in both real and virtual spaces, heavy-tailed step-lengths are also reported.