Using Exact Sciences Modeling Tools to Understand Social Phenomena

Course #: 55772

Exercise #4: The emergence of spikes
Due: June 13th, 11:50 pm, on Moodle

Task 1: Make your own study on possible modeling approaches to spikes

Many social phenomena are spiky. A wide range of behaviors such as riots, strikes, voting, migration waves and diffusion of rumors do not evolve smoothly over time, but rather come in bursts of spikes. Researchers who studied strike waves observed that "transgressive contention occurs in waves. People suddenly shift from quiescence to defiance" (Biggs 2005, page 1684). Works on meme tracking explore the spiky time dynamics of memes on news articles show that the frequency at which a specific meme appears increases sharply and then decays sharply. In his well-known book "Bursts", Barabasi describes the spiky pattern of social and historical events, such as crusades, crimes, and personal productivity.

In class, we presented several modeling approaches to describe bursts. In this homework assignment, we want you to explore an additional one. This approach compares spikes to a marine phenomenon called rogue waves (Hebrew: גלי פרא).

Here is what we ask you to do:

1. Read a bit about rogue waves: https://physics.aps.org/articles/v2/86
2. See how they exist not only in the ocean
http://www.nature.com/nature/journal/v450/n7172/abs/nature06402.html
(the paper is attached).
3. Read and understand (even if superficially) the modeling approaches
http://www.sciencedirect.com/science/article/pii/S0997754603000724
(the paper is attached).
4. (*20pts*) Summarize (no more than 1 page) the phenomenon, where is it observed in nature, based on 1, and 2.
5. (*30pts*) Choose **one** of the models in article 3, make an effort to understand it. Explain it carefully in your words (no more than 2 pages).
6. Now suggest how this modeling approach can be applied to modeling social spikes.
    a) (5pts) What kind of social spikes (e.g. riots, strikes, word-of-mouth, other spikes, spikes in general) can be described using the modeling approach you have chosen? Explain.
    b) (*10pts*) What are your assumptions? Be detailed, work carefully.
    c) (*10pts*) Show the equivalence of each and every variable and parameter: the model in the paper vs. your model Vs. the reality. The easiest way is to create a table listing all the parameters and variables and state the equivalence.
    d) (15pts) Describe how the relationships between the variables and parameters in the original model describe the relationship in the spiky phenomenon you

have chosen. Note that you are allowed to make some changed to the original model in order to describe better the real phenomenon. This is the core of the modeling work! Do it intelligently.

e) (*5pts*) What are the scenarios to which your approach might best fit?
f) (*5pts*) Give one example of where the equivalency breaks. i.e., in which scenarios the similarities between the rogue wave and your model might fail.

Congratulations, you have now made the first real step in becoming a modeler.

In this homework - please submit only one PDF file.
name the file: **ex_4_First_Last.pdf** (with your first and last name).
no .docx, no jpg no scanned handwritten work.