An Alternative Model Hitting the Runway

ABSTRACT

The purpose of this project was to find a model that best describes how individuals conform to their surroundings to join particular social arrangements based on shared beliefs and interests. This was accomplished through applying a modified SIR model that included four additional parameters to showcase how they affected the probability rate of the model. Through this application, it was concluded that under a given set of parameters the "infected" individuals would always spike before leveling off when the trend faded away.

INTRODUCTION

The way people tend to allocate themselves into certain schemes and sects has always been a hotbed of research, as to predict how people will respond to situations is lucrative regarding almost every industry imaginable. One such industry is that of the fashion world. Whether a hipster, goth, or even prep, all these subgroups intermingle and conform to some sort of ideal that encompasses their values. Having stated this, the true problem at hand is to examine the propensity of a person in an established group to alter their appearance and conform to expectations over time. One way that this could be properly examined is through the SIR model, which is used to mathematically model the spread of infectious diseases. This model fit the purpose of the project in that the spread of fashion trends amongst the population often spread much like an illness through contact.

MODEL

As mentioned previously, a fair representation of how people change their affiliation with a certain subgroup can be shown through the SIR model.[1] This model is described by a given set of ordinary differential equations, stated:

$$\frac{dS}{dt} = -\beta SI,$$

$$\frac{dI}{dt} = \beta SI - \gamma I,$$

$$\frac{dR}{dt} = \gamma I,$$

$$N = S + I + R,$$

where N represents the whole population, S shows the number of individuals susceptible to the disease, I is the number of individuals infected by the disease, R represents the number of individuals who have been infected before recovering from the disease, β is the probability rate of contracting the disease, and γ is the recovery rate.

The original model assumes that the probability rates β and γ are equal for everyone in the population. This contradicts the updated model's initial condition that a change within certain subgroups depends on numerable social variables. In order to account for this difference, the updated model assumes that N instead represents the population of the certain subgroup alone (i.e. people of the same age, personality, social class, and popularity). After this slight change, the above equations can be used to predict the behavior of the certain subgroup, and the individual's rate of changing to another subgroup. One scenario that benefits both models is that the R value continues to represent the individuals that have already been infected/changed and once this has occurred, they cannot revert to their previous state of conditions. In the updated model, the changing rate β depends on four predetermined factors. The age factor, a, is considered the most important. Social class, s, was divided into 3 categories: indigent, middle-class, and wealthy. Personality, p, was also divided into 3 categories: extrovert, introvert, and ambivert. Popularity, *pop*, was considered as the determining factor of how many people an individual interacts with daily and is distinguished by the average size of the individual's close friend group, such as 1-3, 4-6, or 7-9 members. The factors are weighted in the equation between values of 0 and 1 to show how they are interrelated with the probability of the individuals with these traits to switch subgroups over time.

Factors	***Low Risk*** (0 – 0.6]	***Medium Risk*** [0.7 – 1.2]	***High Risk*** [1.3 – 2)
Age (years)	41-60	0-20	21-40
Social Class	Indigent	Middle Class	Wealthy
Personality	Introvert	Extrovert	Ambivert
Popularity	1-3 close friends	4-6 close friends	7-9 close friends

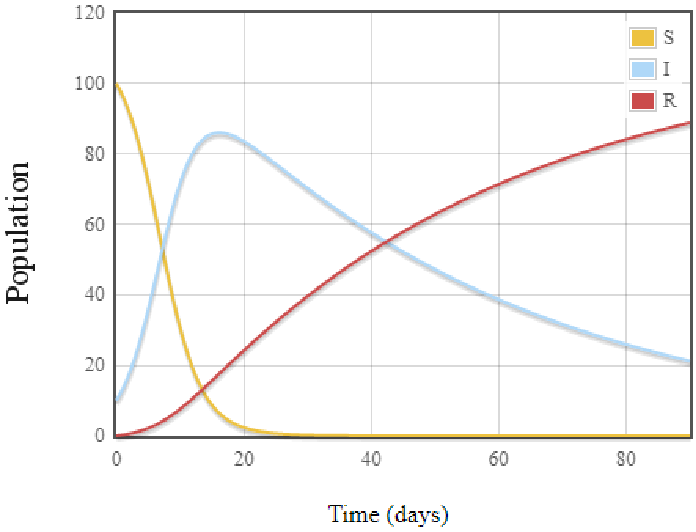
Taking all of that into consideration, we concluded that the probability rates β and γ can be determined as:

$$\beta = a^{1/2} * s * p * pop^{1/2} \text{ under condition a<1 and pop<1}$$

OR

$$\beta = a^{2} * s * p * pop^{2} \text{ under condition a>1 and pop>1.}$$

To illustrate how these variables influence the equations, the SIR model generator was used.[2]



CONCLUSIONS

Predicting human behavior and putting it into schemes will never work perfectly. It will always require multiple assumptions and generalizations that may work for the majority, but not necessarily for the minority or an individual. Nevertheless, using the proposed model of treating a spreading trend or fashion like an infectious disease may represent an adequate start. The proposed factors were crucial in the successful finding of a trend, although the situation permits further development and research to acquire practical data for applications.

REFERENCES

[1] Keeling and Rohani. Introduction to simple epidemic models.

[2] http://www.public.asu.edu/~hnesse/classes/sir.html, accessed November 2019.