Experiments and Results PoS

Cristian Pulido

Universidad Nacional de Colombia

April 3, 2018

Outline

Introduction

In this presentation, some experiments and their respective results related to the Perception of Safety (PoS) project are described and shown.
Among others are:

- Reconstruction of some experiments.
- Comparison with new hypothesis.

Description

The model used in principle is explained in [2], which tries to predict the behavior of the perception of security in a fixed region over time, with rules of behavior based on criminal events, the passage of time and communication between the individuals of the region.
Main features

- Each person has a PoS value which is interpreted as the probability that a person will consider the region as insecure.
- The passage of time is discrete, can be weekly, monthly, annual, among others. In these experiments periods of one week are used.
- For the communication between the people of the population couples are chosen randomly formed on all the people.

Experiment No 1

In this experiment the objective is to compare the behavior of the PoS when the only difference is the distribution of the crime in the population. There are two groups of 5000 people, during 4 years the PoS is followed in each group with $\psi = 0.5$, $\nu = 0.9$, $\mu = 0.1$, in each group the 20% of the population is chosen randomly for communication.
In both groups a portion of each one suffers exactly one criminal event, the difference is that in group 1 this portion is fixed and in group 2 the portion is chosen randomly in each period.

Experiment No 1

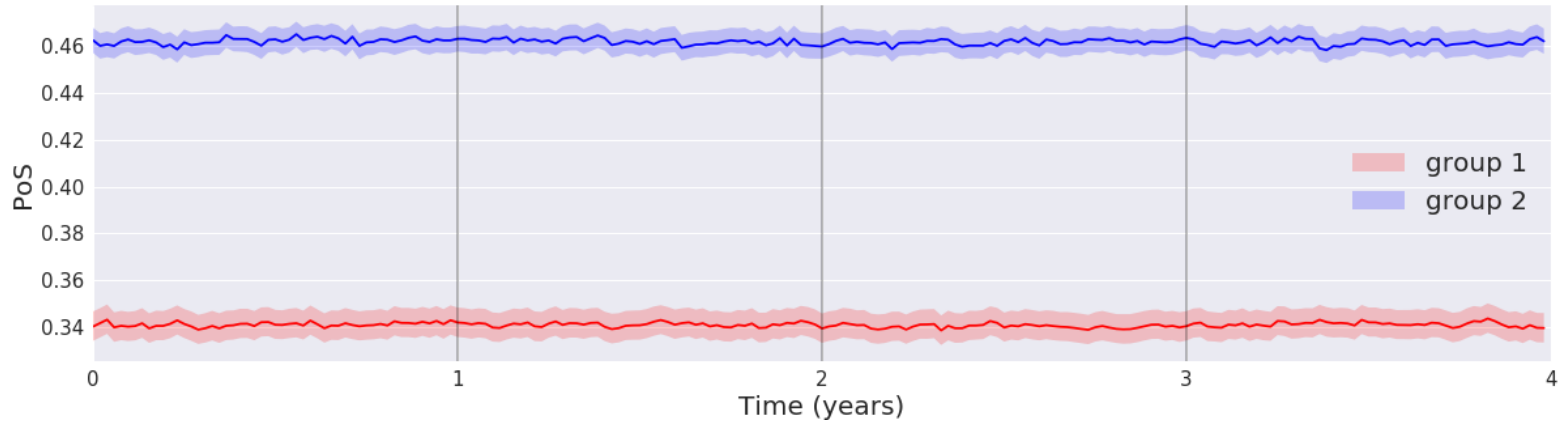


Figure 1: PoS, comparison distribution of the crime.

It is observed that comparing the average value of the PoS in both groups, the group with the portion of victims of crime fixed is less than the other, this because the people who do not belong to the fixed portion will never be victims of the crime and thus, the fear of crime is concentrated in the victims of crime, while in the other group each of the persons has the possibility of being a victim of crime, with which the fear of crime is homogeneous over the entire population.

Experiment No 2

For this experiment the objective is to show the behavior of the PoS for the population when the average of the crime is variable.
On this occasion there is a population of 10,000 people with $\psi = 0.9$, $\nu = 0.9$, $\mu = 0.1$, the population is divided into 3 characteristic groups, each with a weekly average (λ) of a different crime, that is, the 65% is an immune group ($\lambda = 0$), the 30% is an occasional victim ($\lambda = 0.05$) and the remainder are frequent victims ($\lambda = 0.5$). To see the behavior of the PoS when the average of the crime is varied, 20 years are simulated, starting with a zero average and each year increasing a value of 0.1 times the original crime average.

Experiment No 2

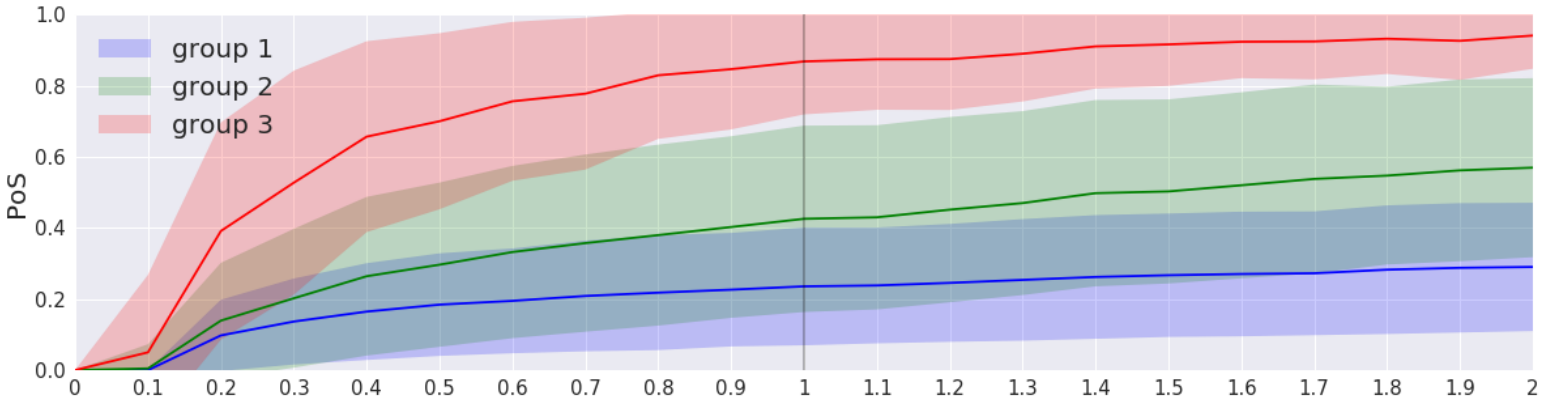


Figure 2: PoS, Variable crime average.

As expected the PoS of each group increases when the average crime does, even the immune group is affected by the communications it has with the other groups.

Experiment No 3

Homophily is a concept that determines the preference of a relationship with people with common characteristics, for this experiment it is tried to prove the relationship between the PoS of a community with the previous three groups according to their average of crime and the level of general homophily of community.
Homophily is represented by a real number between 0 and 1, where 1 means that all communications are given on the same group and 0 on the others.
On this occasion there is a population of 10,000 people with $\psi = 0.9$, $\nu = 0.9$, $\mu = 0.1$, the population is divided as in the previous experiment. For each homophily value, 4 years of PoS are simulated and the mean is found over time and over each of the groups.

Experiment No 3

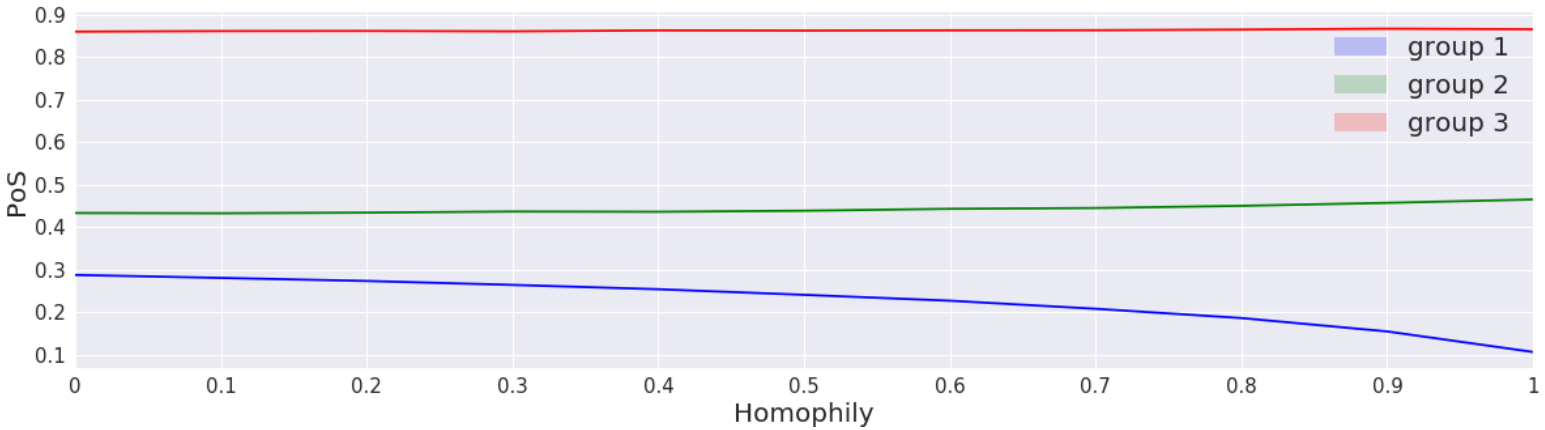


Figure 3: PoS, homophily.

It is observed in the figure that when the homophily is close to zero (communications with different group) the PoS value of each group is close and while homophily is increased the PoS of each group is in accordance with its crime average, for example for the immune group their PoS tends to zero as they are not victims of crime and they communicate with each other, their fear of crime is almost nil, on the contrary for the group with frequent criminal events their level of fear is very high.

Description

Analyzing the model highlights a feature in which communications are generated randomly over the entire population, this is unrealistic since one could think that a person talks about their perception of security with people with whom they have confidence and there is already a previous relationship.
Therefore, for the model to be a bit more realistic, an underlying graph was added in which, its nodes represent the people and their edges if there is a relationship between two people.

The Graph

The graph is generated with the help of the Attributed Graph Generator with Community Structure software, which is explained in the article [1], as the name indicates it generates a graph divided into communities and each person has attributes, which in the model can represent Characteristics of people, such as age, ethnicity, socioeconomic position, geographical position in the region, among others.
To integrate the model with the graph we use the edges of each node to identify with whom the communication is given, is to say the communication will no longer be random over the entire population, but random over the connected nodes.

Experiment with graph No 1.

As a first experiment using the graphs we want to compare the result obtained with the graph and without it, for this the software generates a graph with 1000 people divided into three groups (the same as before according to their crime average).
Then the PoS model is used with the resulting data of the software, obtaining a graph, which will be compared with the one generated by the model with the same data, except that the communications will be random again over the entire population.
Parameters for both images $\psi = 0.9$, $\nu = 0.9$ and $\mu = 0.1$, only 20% of the population communicates.

Experiment with graph No 1.

A graphic representation of the generated graph is:

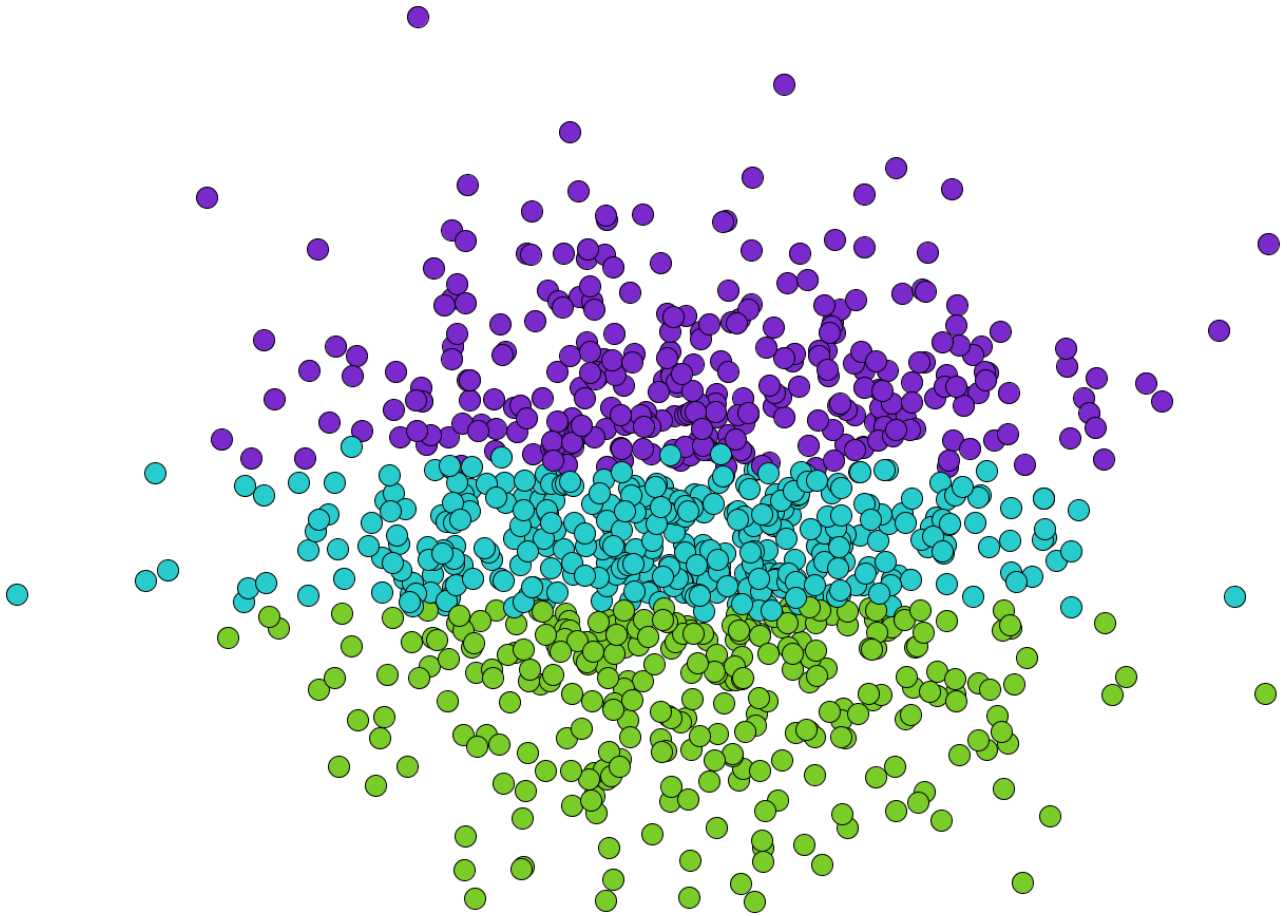


Figure 4: PoS, Underlying graph without edges.

Experiment with graph No 1.

A graphic representation of the generated graph is:

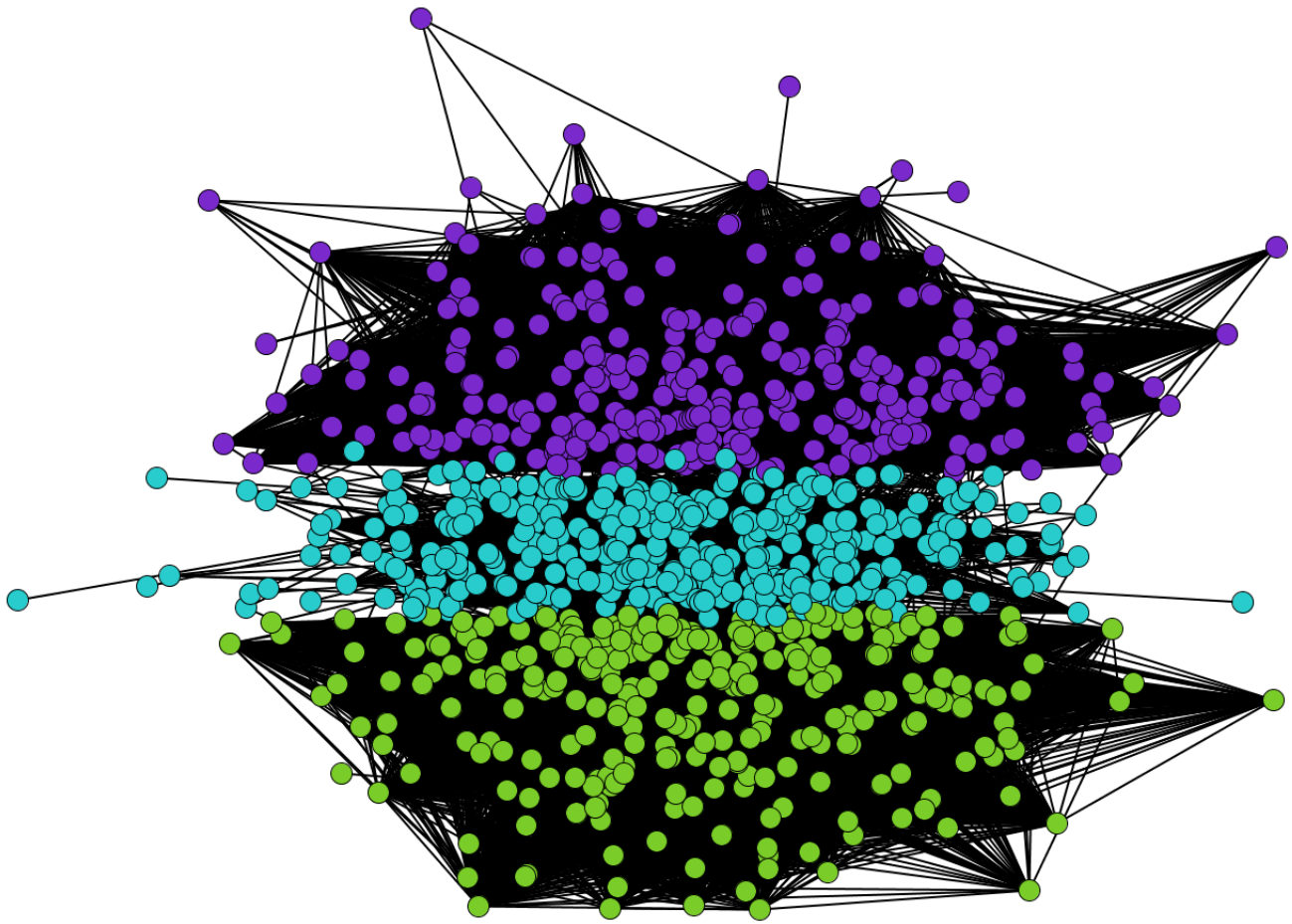


Figure 5: PoS, Underlying graph with edges.

Experiment with graph No 1.

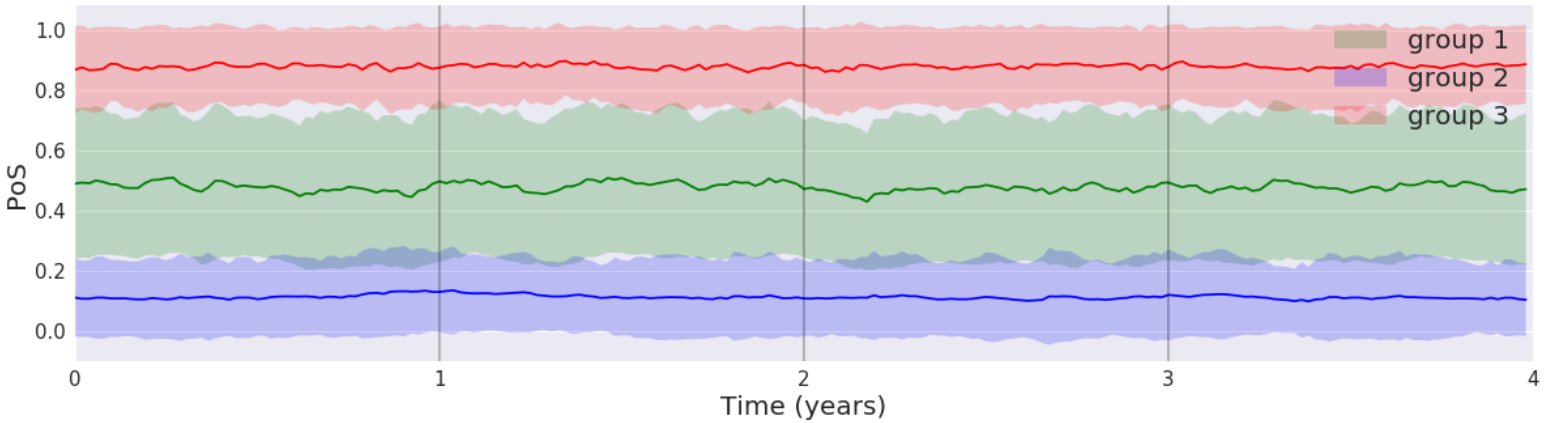
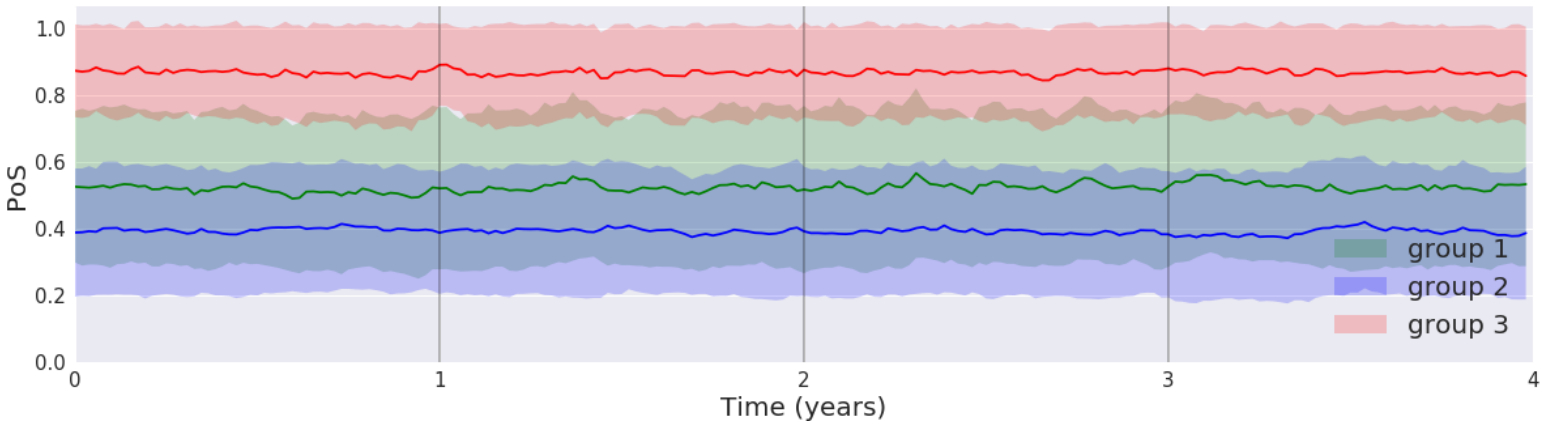


Figure 6: PoS, Using underlying graph.



Experiment with graph No 1.

It is observed that in the image that the graph uses the PoS of the groups is smaller than in the other graphic, mainly the immune group, this can be explained by the fact that using the communications based on the graph the possibility that a person of the The immune group communicates with a person from the group of frequent victims is scarce, and therefore this fear is not transmitted in the same way, therefore the level of PoS for them is lower. In addition, the value of homophily for the first is 0.927 and for the second is 0.33.

Experiment with graph No 2.

As a second experiment in this section as a comparison, the PoS is simulated when the crime average is variable and using the generated underlying graph.

Experiment with graph No 2.

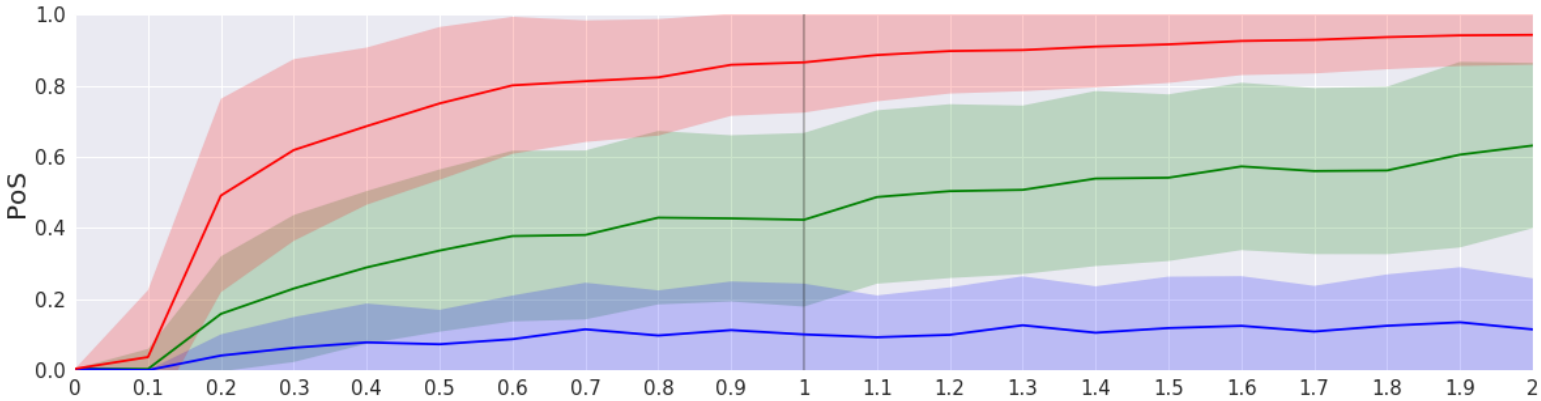
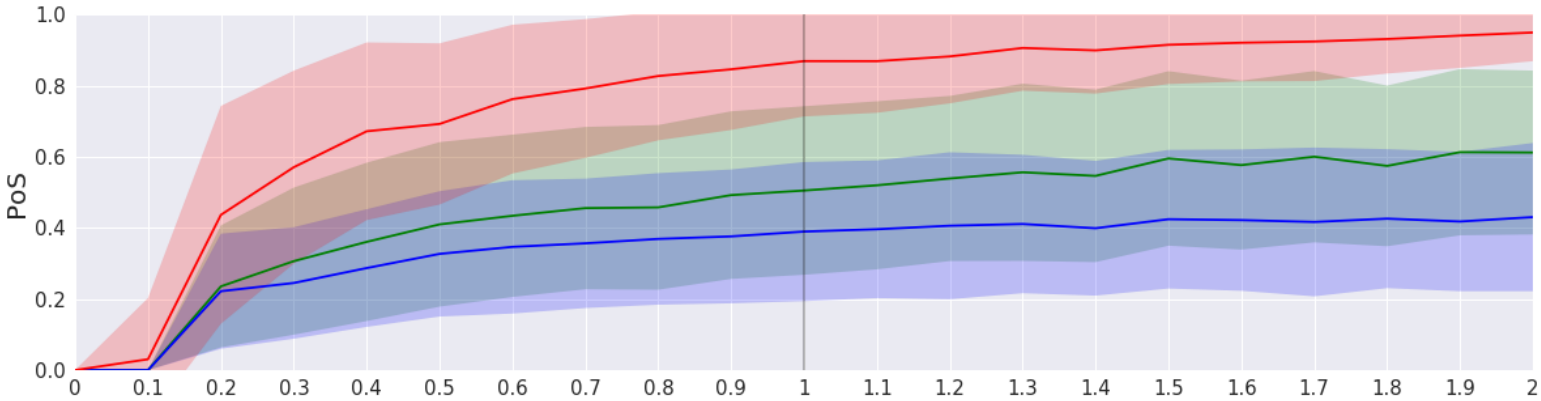


Figure 8: PoS, Using underlying graph.



Experiment with graph No 2.

As it is observed, the growth behavior is maintained but thanks to the underlying graph at least for the immune group the growth is not so great compared to the image where the graph is not used.

Bibliography I

[1] Christine Largeron, Pierre-Nicolas Mougel, Reihaneh Rabbany, and Osmar R. Zaïane. Generating attributed networks with communities. *PLOS ONE*, 10(4):1–21, 04 2015.

[2] Rafael Prieto Curiel and Steven Bishop. Modelling the fear of crime. *Proceedings of the Royal Society of London A: Mathematical, Physical and Engineering Sciences*, 473(2203), 2017.