Nonlinear Science Working Group

20th International Symposium on Disordered Systems: Theory and Its Applications

"COMPLEXITY and COVID-19"

20 December 2020, Online

Abstract Booklet

Purpose of the Symposium

This scientific event will provide a good opportunity for complexity, nonlinear science & multidisciplinary field scientists and participants who are interested for information exchange. The objective of this symposium organized by Nonlinear Science Working Group which was founded 2001 is to bring together leading specialists and young scientists working on various aspects of complexity and nonlinear science, to discuss the most recent developments in that area.

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SYMPOSIUM PROGRAM

Nonlinear Science Working Group
for exploring complex worlds
Since 2001
www.non-linearscience.org

20th International Symposium on "Disordered Systems: Theory and Its Applications" (DSS-2020)

20 December 2020, Online

"COMPLEXITY and COVID-19"

ATTENTION: All times reported for the DSS-2020 are Turkey time (GMT+3).

PROGRAM

12:55-13:00 Welcome and Opening /Online group photo

13:00-13:25 Education as a Complex System in the Post COVID-19 World
Fatimah Abdul Razak
Universiti Kebangsaan Malaysia, Malaysia (The National University of Malaysia)

13:25-13:50 Spread of COVID-19 in Slums of the Developing World
Anand Sahasranaman, Henrik Jeldtoft Jensen
Krea University, India - Imperial College of London,UK

13:50-14:15 Understanding Global Reflexes to COVID-19 with Autopoiesis System Approach
Şuay Nilhan Açıkalın, Şefika Şule Erçetin
Ankara Hacı Bayram Veli University, Ankara, Turkey

14:15-14:40 Complexity and Entropic Behaviors of COVID-19 Pandemic in Europe
Nazmi Yılmaz, Mahmut Akıllı, G.Cigdem Yalcin, K.Gediz Akdeniz
Koc University, Istanbul,Turkey

14:40-15:05 A Novel Methodology for Epidemic Risk Assessment: the Case of COVID-19 Outbreak in Italy
Alessandro Pluchino, A.E.Biondo, N.Giuffrida, G.Inturri, V.Latora, R.Le Moli, A.Rapisarda, G.Russo, C.Zappalà.
University of Catania, Italy

15:05-15:30 Early Stages of the COVID-19 Pandemic: Phenomenological Curves and Epidemiological Models
Ugur Tırnaklı
Ege University, Izmir, Turkey

15:30-15:40 Discussion and Closing /Online group photo

ABSTRACTS

Education as a Complex System in the Post COVID-19 World

Fatimah Abdul Razak
Universiti Kebangsaan Malaysia, Malaysia (The National University of Malaysia)

In the era of Covid-19, students are questioning the value of higher education. Perhaps one answer to this 'crisis of higher education', is the sense of community and belonging to a group facilitated by the educators. This is particularly challenging for the multi-ethnic and multi-religious country such as Malaysia and we examine the different factors. The interactions in the communities can potentially bring out more from the individual students. The 'whole' may indeed be greater than the sum. A complex network point of view may be able to help educators in facilitating and quantifying interactions and information exchanges amongst students in light of bringing out this greater 'whole' and sense of community for a more effective peer-to-peer learning. Moreover, the student friendship networks can be used as an underlying contact networks to model possible epidemic spread in an effort to suggest effective reopening strategies for institutions.

Spread of COVID-19 in Slums of the Developing World

Anand Sahasranaman, Henrik Jeldtoft Jensen
Krea University, India - Imperial College of London, UK

Slums are an emergent feature of urban landscapes in developing urban metropolises. From Manila to Mumbai, Cario to Cape Town - all of these cities are characterized by large slums neighbourhoods. The spread of Covid-19 in cities raised concerns about the vulnerability of urban slums in Asia and Africa. We look at the data of spread of Covid-19 in 6 developing world cities, and study the distribution and temporal evolution of cases since the onset of the pandemic. In this talk we will explore the following questions: How vulnerable have slums been to the infection and what is the distribution of caseloads across slums and non-slums in cities? What has been the experience and challenges of both slum dwellers and city governments in responding to the pandemic? What can models tell us about spread in slums? What needs to be done in slums to prepare for future episodes of infectious spread?

Understanding Global Reflexes to COVID-19 with Autopoiesis System Approach

Şuay Nilhan Açıkalın, Şefika Şule Erçetin
Ankara Hacı Bayram Veli University, Ankara, Turkey

Covid-19 pandemic is and will be remarkable cornerstone in the world history which disrupted and transformed every aspect of our lives. Undoubtedly, not only pandemic itself but also reactions and reflexes of societies in international system have been game changer in history of humanity. Most of the countries have experienced protests against Covid-19 measures and lack of willingness to form global cooperation and governance in a truculent way. In this respect, this work attempt to explain the question of "how communication plays role in these unexpected and au courant global reflexes to Covid-19 with the approach of autoipoietic system which developed by Luhmann to understand dynamics of societies and role of communication. This analysis shows that mobilization of misinformation vis a vis post truth in international system triggered global reflexes.

Complexity and Entropic Behaviors of COVID-19 Pandemic in Europe

Nazmi Yılmaz[1], Mahmut Akıllı[2], G.Cigdem Yalcin[3] and K.Gediz Akdeniz[2]
[1]Koç University, College of Sciences, Department of Physics, Istanbul, Turkey
[2]Disordered Systems Working Group, Istanbul, Turkey
[3]Istanbul University, Faculty of Science, Department of Physics, Istanbul, Turkey

Complexity scientists and chaos theoreticians have also taken an interest in studying the COVID-19 pandemic. Several network models of the pandemic have been suggested with the aim of predicting the future behaviour of the pandemic around the world. Medical science certainly benefits from such studies even though their approaches in studying the pandemic are completely different. Especially, the characteristics of the spread of the pandemic in different countries can give us insight into the societal reactions to the pandemic and the sociologic and economical structures in those countries.

In this work, the complexity of the COVID-19 pandemic will be discussed based on previous studies. Also, the entropic behavior of the pandemic in Europe will be analyzed using the daily case data from the beginning of the pandemic to December 13th, 2020. And five big countries in Europe (UK, Germany, France, Italy and Spain) will be classified by the predictability of the spread of the pandemic. Then the reasons for the difference in the predictability of the pandemic between the European countries and Turkey, Russia, and Iran during the same period will be examined. In conclusion, our COVID-19 entropy results will be discussed for the possibility of correlation with country classifications in other methods.

A Novel Methodology for Epidemic Risk Assessment: the case of COVID-19 outbreak in Italy[1]

Alessandro Pluchino[1], A.E.Biondo[2], N.Giuffrida[3] , G.Inturri[4], V.Latora[1,5,6,7], R.Le Moli[8], A.Rapisarda[1,5], G.Russo[9], C.Zappalà[1].

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The prediction of the future developments of a natural phenomenon is one of the main goals of science, but it remains always a great challenge especially when the phenomenon that one is observing involves people that can have a feedback reaction on the observed quantities. This is particularly true in the case of epidemics, especially with the COVID-19 outbreak that the world is suffering in this period. We propose a novel data-driven framework for assessing the a-priori epidemic risk of a geographical area and for identifying high-risk areas within a country. Our risk index is evaluated as a function of three different components: the hazard of the disease, the exposure of the area and the vulnerability of its inhabitants. As an application, we discuss the case of COVID-19 outbreak in Italy. We characterize each of the twenty Italian regions by using available historical data on air pollution, human mobility, winter temperature, housing concentration, health care density, population size and age. We find that the epidemic risk is higher in some of the Northern regions with respect to Central and Southern Italy. The corresponding risk index shows correlations with the available official data on the number of infected individuals, patients in intensive care and deceased patients, and can help explaining why regions such as Lombardia in particular, but also Emilia-Romagna, Piemonte and Veneto, have suffered much more than the rest of the country. Although the COVID-19 outbreak started in both North (Lombardia and Veneto) and Central Italy (Lazio) almost at the same time, when the first cases were officially certified at the beginning of 2020, the disease has spread faster and with heavier consequences in regions with higher epidemic risk. Our framework can be extended and tested on other epidemic data, such as those on seasonal flu, and applied to other countries. We also present a policy model connected with our methodology, which helps policy-makers to take informed decisions.

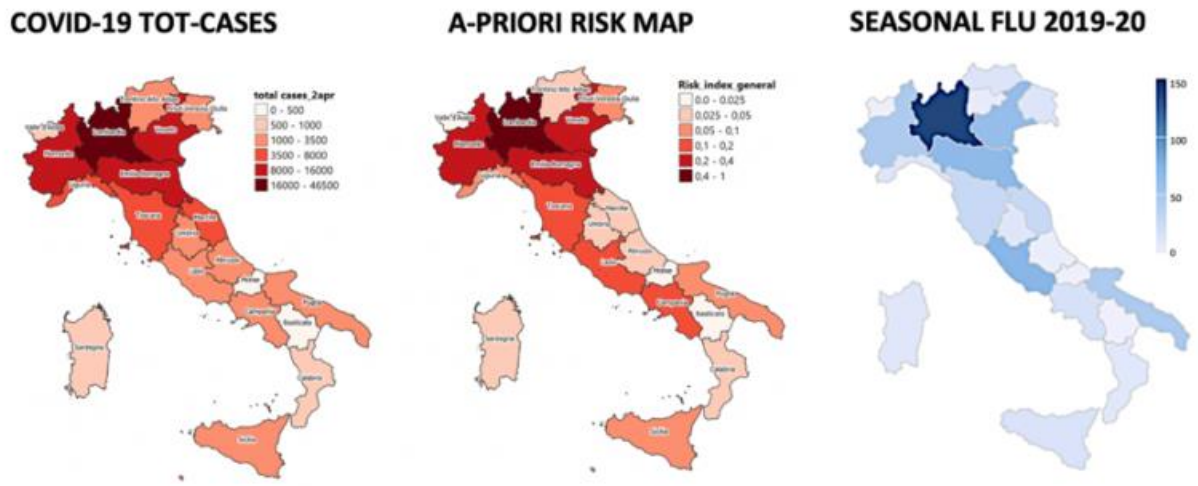

Figure 1: (a) Spatial distribution of COVID-19 total cases in Italy; (b) A-priori risk map; (c) the most struck regions from 2019-2020 seasonal flu according to the ISS data. The geographical correlation with the risk map is evident for both the epidemic flus.

References

[1] https://scientific-reports-under-consideration.nature.com/posts/a-novel-methodology-for-epidemic-risk-assessment-the-case-of-covid-19-outbreak-in-italy

Early Stages of the COVID-19 Pandemic: Phenomenological Curves and Epidemiological Models

Ugur Tırnaklı
Ege University, Izmir, Turkey

For the early stages of the Covid-19 pandemic, we propose two models, one of which is phenomenological based on a q-statistical functional form, and the other is a generalization of the well-known epidemiological model SEIR with anomalous kinetics. The results obtained from both models appear satisfactory for the first wave of the pandemic in several countries.