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Editorial: Interdisciplinary approaches towards the evolution of socio-economic systems under selective trend pressures

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Editorial on the Research Topic

[Interdisciplinary approaches towards the evolution of socio-economic systems under selective trend pressures](#)

Introduction

The evolution of our society, symbolized by AI developments, is overwhelmingly bounded by transhumanistic drives. This kind of driving force is steadily endangering traditional borders such as human/machine, material/immaterial, production/consumption, and so on. This results in more and more boundary collapses and the intrusion of heterogeneous elements, whether biological, social, or ethical. Observation of these events will have to become increasingly interdisciplinary. Thus, the articles in this Research Topic are all relevant to the theme “Interdisciplinary Approaches Toward the Evolution of Socio-Economic Systems”. The last article on [Yen and Cheong](#) deals with the problem of “Selective Trend Pressures.” At the end of the last century, the idea of chaos gave us a new way to interpret time series independently of those probabilistically generated. This idea is rapidly evolving with the progress of AI. Subsequently, new tools such as network analysis have been developed with the evolution of AI learning. The appearance of Generative Pre-trained Transformer (GPT) is considerably changing the quality of analysis. In the data-based approach, “a highly accurate generator of human mobilities” matters. The rapid progress of data-based technology will give a wonderful prospect on the highly accurate reproducibility of reality. Incidentally, in case of the evidence-based approach, reproducibility has another meaning. Benjamin et al. [1] stated that the p -value threshold for declaring new findings statistically significant should be tightened from 0.05 to 0.005. This means that an actionable step to 0.005 will immediately improve “reproducibility” (Matthews [2]). Thus, we will discuss the other meaning of reproducibility, different from the latter.

The articles in this Research Topic all conform to an interdisciplinary approach to the evolution of socio-economic systems. As often seen, the evidence-based approach is prevalent in

medicine and many behavioral sciences. In this Research Topic, on the other hand, all the articles, except for one, can be classified into the data-driven approach. Social evolution in the 21st century is causing quite profound structural changes that defy conventional wisdom. In our context, the approach of social physics is forced to be interdisciplinary, as briefly discussed. Thus, roughly speaking, we keep interdisciplinary physics in mind as interdisciplinary studies in social physics.

International center for the advancement of multidisciplinary studies on socio-economic systems

The perspective article titled [Banerjee and Mitra](#) after a historical briefing, calls for the establishment of an international center of excellence in interdisciplinary physics. In the past, as Figure 1 of the article describes, there were at least three challenges: the European social observatory (2011), Asian economic observatory network (2012), and international center for social and natural scientists (2016). While these achieved some success, they did not lead to the establishment of permanent institutions. This article challenges the community to establish a permanent center for interdisciplinary physics.

International cooperation analysis of the Asian political distance network, constructed using event data

Our editorial members happen to come from Asian districts. Nowadays, the world can no longer progress without BRICKS member countries. Thus, the International Center for the Advancement of Multidisciplinary Studies mentioned above must also be connected with BRICKS. However, BRICKS may be too large for this kind of analysis to be applied. Therefore, it may be convenient for us to restrict the area under analysis to a smaller region; e.g., taking ASEAN and its surrounding countries such as China, Japan, and the United States. The article titled [Sada et al.](#) provides a political distance network analysis over the last 35 years in the Asian and Pacific area. In this analysis, it was key to quantify multilateral diplomacy within the region. As the authors stated, this study analyzed the region from three perspectives: countries that have contributed to diplomacy for intra-regional cooperation (diplomatic ranking), the cohesiveness of countries in diplomatic stances (diplomatic clusters), and the synchronization period of cooperative events (diplomatic synchronization). Japan, China, and the United States were the analytical targets; India was dropped in this article. In this sense, this article still remains a first step in providing intelligence on how to locate the international center.

Optimizing travel routes using temporal networks constructed from global positioning system data in Kyoto tourism

Needless to say, the era of nonlinear science led us to a set of new approaches, separating from the equation-based systems

approach. The era has rapidly evolved with much larger AI intelligence. Currently, simulation methods are combined with the incessant provision of a particular type of data such as GPS, as well as with a new learning method such as machine/deep learning. [Mukai and Ikeda](#) is typical research fulfilling the new trend of such analytical methods.

This article is a more modern example of solving the time-dependent traveling salesman problem (TDTSP), although the research target was to optimize travel routes in Kyoto tourism. It is noted that the traveling salesman problem was the kind of problem for which a traditional mathematical solution was difficult to obtain. We can see that a fine result was obtained with the use of temporal networks. This is a good job in the context of a “big” data-based approach in a complex world.

Generation of individual daily trajectories by GPT-2

In this article, the modeling of human mobility in terms of social physics is challenged. The authors succinctly summarize the modeling of human mobility. According to them, this kind of modeling can be classified into four types. The first type is the Trajectory Generation model that generates realistic individual spatial-temporal trajectories. The second is the Flow Generation model that generates realistic Origin-Destination matrices. The third is the Next-Location Prediction model that predicts an individual’s future location. The fourth type is the Crowd Flow Prediction model that predicts in/out aggregated crowd flows.

On the other hand, generative models can be created using a combination of physics and learning approaches. Here physics traditionally implies the gravity model, the preferential selection model, the Markov chain, and the autoregressive model. The authors’ ambition is to generate much more realistic trajectories by means of GPT-2. Thus, they focused on the following fact: machine learning approaches include language models and autoregressive-type neural networks. This approach generates highly realistic individual trajectories by building complex models with many parameters.

We emphasize that a highly accurate generator implies a type of reproducibility of the concerned event. In this sense, this kind of data-based approach would give good prospects for reproducibility.

Scientific debate on human migration: ethics, challenges, and solutions

In this article, one of the core ideas is niche. A niche is generally a menace to the other niches it borders. Thus, each niche is always exposed to some selective pressure. This article studies a case of the Evolution of Socio-economic Systems “Under Selective Trend Pressures.” More interestingly, the authors’ interest goes beyond “niche” and includes niche-niche interactions. They designed a particular adaptive system of multiple niches. In their own words, they wrote down sets of

ordinary differential equation models of these interactions on a star network, for isolated ecosystems or communities, as well as those experiencing invasions (or niche attachments) at a periphery node or at the core node.

We do hope the readers, younger ones in particular, will enjoy and get a good perspective of the current research in this challenging interdisciplinary field.

Author contributions

YA mainly made the manuscript. BC revised it. TM and HS acknowledged it. All authors contributed to the article and approved the submitted version.

References

1. Benjamin DJ, Berger JO, Johannesson M, Nosek BA, Wagenmakers EJ, Berk R, et al. Redefine statistical significance. *Nat Hum Behav* (2018) 2(1):6–10. doi:10.1038/s41562-017-0189-z

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2. Matthews R. The p-value statement, five years on. *Significance* (2021) 18(2):16–9. doi:10.1111/1740-9713.01505