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[\[Revolutionary Biology\]\[International Cooperation\] Unveiling the Myth of Analyzing Statistics and Detecting Causality, NTU International Team Had Recent Research Result Published on 《Science》](#)

[Revolutionary Biology][International Cooperation] Unveiling the Myth of Analyzing Statistics and Detecting Causality, NTU International Team Had Recent Research Result Published on 《Science》 ([Chinese Version](#))

NTU Spotlight Professor Chih-hao HSIEH of NTU Institute of Oceanography and Institute of Ecology and Revolutionary Biology and his international research team have just had the recent research result published on Science on October 26: "Detecting Causality in Complex Ecosystems". Their new approach of analyzing the real cause in complex ecosystems has successfully made it possible to detect the cause and effect, and furthermore they solved the myth of the related statistics in analysis of the causality, which have been baffling scientists for quite a long time.

It goes well with this old Chinese saying, "wind rises with the moon halo. Rain comes along with the wet base stone of the column 月暈而風 礎潤則雨." However, the moon halo is not what causes the rising wind, and the wet base stone is not the cause of the rain. It is not exactly as it seems to be that two related objects could result in the cause and effect. Take a simple daily case for example, we tend to feel flighty and impetuous in the summer. And ice cream usually has the better sale in the summer, so it's easily and very likely that we relate our being flighty and impetuous to the ice-cream sale in the summer, when it comes to the statistics. However, we should bear this in mind that it is irrelevant to conclude the cause and effect in this case. Instead of that, it is only because of the influence by the weather condition in the summer. This hilarious example shows not only a ridiculous joke but also a typical case while doing the researches in the ecosystems, making a certain case the unsolved, baffling task. To be more specific, the species' close connection in the natural world might be resulted from the species' interaction between these two species as well as the influence from the same environmental factors on the two species at the same time. The related statistics between them does not suggest the cause and effect in it; instead, it does not mean that there is no causality between two objects, which appear to be not related. The fact is, in the real ecosystems, it can get very complicated with the changing factors, and finding the real key factor is also as difficult as searching a needle in the vast ocean.

It was not until the new method from Professor Clive GRANGER and Professor Robert ENGLE that the myth in the natural world could be unveiled. The two professors gave up the conventional scientific approach by using the relativity; instead, they based on prediction to analyze the cause and effect. What they have predicted has already been successfully proved true in analysis of the data of finance and economics. This scientific breakthrough won them the Nobel Prize of economics in 2003. Professor Clive GRANGER and Professor Robert ENGLE designed their method according to the linear stochastic systems. Though this method has successfully solved parts of the causality and the correlation, it does not apply well in the nonlinear dynamic systems, which has been organized by rules in ecosystems.

In order to detect the causality and the correlation in complex ecosystems, Professor Chih-hao HsIEH has successfully developed convergent cross mapping with his NTU research team for the detection. In simple words, Professor HSIEH's method is based on this Chinese saying, "It leaves the trace after every footprint." His research team used data from convergent cross mapping to detect whether an object did leave the trace in another object's history. If so, they can prove it true that this object is actually the causing effect. Their scientific approach is illustrated both by simple models and by application to real ecological systems.

In the publication on Science magazine, Professor Chih-hao Hsieh and his NTU research team used convergent cross mapping to analyze the history data of anchovy and sardine, the two major species in the fishery industry in the Californian current ecosystem. Their publication, Detecting Causality in Complex Ecosystems, presents how Professor Hsieh and his research team have successfully figured out the long-debating factors of causing the Californian sardines and anchovies have developed changes in their history.

Related Websites:

Time Series and Dynamic Systems <http://youtu.be/7ucgQE3SO0o>

Takens Theory and Shadow Manifolds <http://youtu.be/rs3gYeZeJcw>

Convergent Cross Mapping <http://youtu.be/NrFdlz-D2yM>

Chih-haoHsieh: http://homepage.ntu.edu.tw/~complex/ecoinformatics_c.html

Further Information:

[NTU Spotlight](#)

[National Science Council International Cooperation Sci-Tech Newsbrief](#)

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