CRCIMM

G. TANAKA LAB

[Complex systems dynamics and its applications]

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Complex Systems Dynamics

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Understanding and controlling diseases by mathematical methods

◆Disease Modeling

We aim to understand the spreading of infectious diseases such as pandemic influenza by means of mathematical models and establish a framework to present a better intervention strategies. We are also trying to construct mathematical models describing growth of cells and virus to consider effective treatment strategies for various diseases.

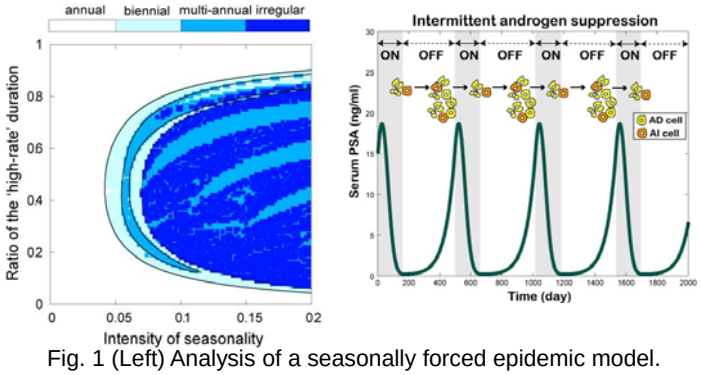

Fig. 1 (Left) Analysis of a seasonally forced epidemic model. (Right) Intermittent hormone therapy for prostate cancer.

Non-hub elements are important for dynamical robustness of complex networks

◆The importance of low-degree nodes

Human contacts, biological cell populations, and the Internet can be viewed as complex networks. It is commonly believed that complex networks are highly fragile to failure of hubs with many connections. However, if the failure of nodes can be compensated by neighboring active nodes, the low-degree nodes are important for maintenance of dynamical functions in the whole network.

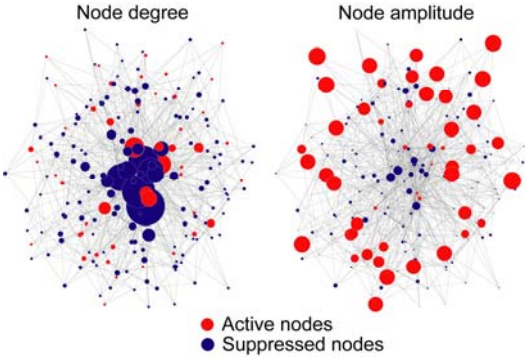

Fig.2 Dynamical robustness of complex networks

Information processing with nonlinearity

◆Complex-valued neural networks

Artificial neural networks imitating biological neuronal networks provide information processing algorithms. We study neural networks dealing with complex-valued data for describing wave phenomena such as electrical, sounds, and lights by applying nonlinear phenomena.

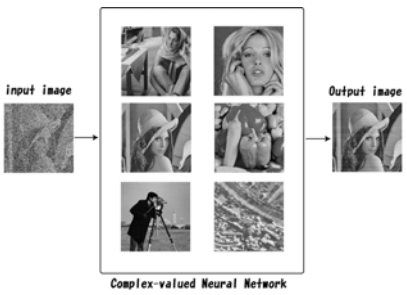

Fig.3 Image restoration with complex-valued N.N.