

Udoy Sankar Basak

Google Scholar • ResearchGate • udoy@pust.ac.bd

Scientific profile

Strong background in mathematics, statistics, and programming. Focus on understanding emergence of self-organization in biological systems. Data-centric experience in various fields including biophysics, fluid dynamics, and molecular dynamics. Scientific programming experience using Matlab, Python, and C++. Recent focus on data-driven approaches to understanding collective behavior. Research experience in time series analysis and causal inference. Familiarity with deep learning and enthusiastically learning more about the subject.

Research Experience

Molecule & Life Nonlinear Sciences Laboratory, Hokkaido University SAPPORO, JAPAN
Research Assistant, Emergent behavior in biological systems *October 2020- March 2021*
PhD fellow *October 2017-September 2020*
Developed a new information-theoretic function for inferring interaction domain among collectively moving groups. Designed generalized models for simulating different types of leadership. Described the development of collective behavior in amoebae using velocimetry and wavelet analyses of cell colony images. Collaborated with biologists and physicists on interpreting analysis results.

Teaching

Pabna University of Science and Technology PABNA 6600, BANGLADESH
Associate Professor, Department of Mathematics *August 06, 2022 to present*

Assistant Professor, Department of Mathematics *November 25, 2016 to August 05, 2022*

Lecturer, Department of Mathematics *November 25, 2014-November 24, 2016*
Taught various subjects at graduate and undergraduate level. Also, taught different programming languages.

Education

Hokkaido University, Sapporo SAPPORO, JAPAN
PhD, Life Science *October 2017-March 2021*

University of Dhaka DHAKA, BANGLADESH
Master of Science in Applied Mathematics *2010 – 2011*

University of Dhaka DHAKA, BANGLADESH
Bachelor of Science with Honours in Mathematics *2006 – 2010*

Publications

Journal Publications

- SM Rayhanul Islam, U. S. Basak. On traveling wave solutions with bifurcation analysis for the nonlinear potential Kadomtsev-Petviashvili and Calogero–Degasperis equations. *Partial Differential Equations in Applied Mathematics* 8, 100561 (2023).
- U. S. Basak, S. Sattari, Md. Motaleb Hossain, Kazuki Horikawa, Mikito Toda, T. Komatsuzaki. Comparison of particle image velocimetry and the underlying agents dynamics in collectively moving self propelled particles. *Scientific Reports* 13, 12566 (2023).
- Md. Ekramul Islam, M. M. Hossain, K. M. Helal, U. S. Basak, R. C. Bhowmik, M. A. Akbar. Solitary wave analysis of the Kadomtsev–Petviashvili model in mathematical physics. *Arab Journal of Basic and Applied Sciences*, 30(1), 329-340 (2023).

4. U. S. Basak, Md. Ekramul Islam, S. Sattari. Inferring interaction domains of collectively moving agents with varying radius of influence. *AIP Advances* 13, 035312 (2023).
5. S. Sattari, U. S. Basak, J.P. Crutchfield, T. Komatsuzaki. Modes of information flow in collective cohesion. *Science Advances* 8 (6), eabj1720 (2022)
6. U. S. Basak, S. Sattari, H.M. Motaleb, K. Horikawa, T. Komatsuzaki. An information-theoretic approach to infer the underlying interaction domain among elements from finite length trajectories in a noisy environment. *Journal of Chemical Physics* 034901.154.3 (2021)
7. U. S. Basak, S. Sattari, H.M. Motaleb, K. Horikawa, T. Komatsuzaki. Transfer entropy dependent on distance among agents in quantifying leader-follower relationships. *Biophysics and Physicobiology*, 18, 131-144(2021)
8. U. S. Basak, S. Sattari, K. Horikawa, T. Komatsuzaki. Inferring domain of interactions among particles from ensemble of trajectories. *Physical Review E*. 102, 1, 12404 (2020)

Submitted Manuscripts

1. Md. Abde Mannaf, Rajandra Chadra Bhowmik, U. S. Basak, Md. Ekramul Islam. Unveiling parametric effects on optical solitons of the Phi-4 model in mathematical physics. Submitted to *Multiscale and Multidisciplinary Modeling, Experiments and Design*.
2. Md. Ekramul Islam, U. S. Basak, Md. Abde Mannaf, Mst. Tania Khatun. Solitons and bifurcation analysis of simplified modified Camassa-Holm model in mathematical physics. Submitted to *Results in Physics*.

Manuscripts in Preparation

1. Md. Motaleb Hossain, S. Sattari, U. S. Basak, M. Toda, Kazuki Horikawa, Satoshi Sawai, T Komatsuzaki. Reversal of velocity field dynamics under blurring the fluorescent images of *D. Discoideum* cells. (In preparation), 2023
2. S. Sattari, Md. Motaleb Hossain, U. S. Basak, Kazuki Horikawa, Satoshi Sawai, T. Komatsuzaki. The development of chemokinesis and chemotaxis in *Dictyostelium Discoideum* cells. (In preparation), 2023

Presentations

Selected Contributed talks

- (i) Basak, U.S., Sattari, S., Hossain, M. M., Komatsuzaki, T. Inferring domain of interactions among *Dictyostelium discoideum* colony from the ensembles of trajectories of cells. Hokkaido-Tohoko Joint meeting of Biophysics, March 08, 2021 (online).
- (ii) Basak, U.S., Sattari, S., Komatsuzaki, T. Identification of interaction distance of a group of collectively moving animals. 5th Hokkaido University departmental Cross-Symposium, Nov. 6, 2019. Hokkaido University, Japan.
- (iii) Basak, U.S., Sattari, S., Hossain, M. M., Komatsuzaki, T. : Identification of Leader(s) in a *Dictyostelium Discoideum* colony: An Information-theoretic approach. The Biophysics Hokkaido branch meeting, organized by The Biophysical Society of Japan, Hokkaido University, Japan, 2018.
- (iv) Basak, U.S., Sattari, S., Hossain, M. M., Komatsuzaki, T. Information-theoretic approach to identify the leader(s) in a *Dictyostelium discoideum* colony. 6th International LIFE-SCIENCE Symposium for young scientists, Hokkaido University, Sapporo, Japan on 19th November 2018.

Selected Poster presentations

1. U.S. Basak, Sattari, S., Komatsuzaki, T. Information-theoretic approach to identify the leader(s) in a *Dictyostelium Discoideum* colony. 4th area conference Poster presentation flash talk, March 4-5, 2021 (Online).
2. U.S. Basak, S. Sattari, M.M. Hossain, K. Horikawa, T. Komatsuzaki. Quantifying the length- and time-scales of influence of cells in collective motion. 6th Annual Hokkaido University Cross-Departmental Symposium. Hokkaido University. Sapporo, Japan. 19 October 2020.

3. U.S. Basak, S. Sattari, M.M. Hossain, K. Horikawa, T. Komatsuzaki. Quantifying the length- and time-scales of influence of cells in collective motion. 58th Annual Meeting of the Biophysical Society of Japan. Online. 18 September, 2020.
4. U.S. Basak, S. Sattari, S. Nicholson, J. Green, M. Toda, T. Komatsuzaki. A sandbox model system for understanding leadership in collective motion. 20th RIES-HOKUDAI International Symposium. Hokkaido University Conference Hall, Sapporo, Japan. 2 December 2019.
5. U.S. Basak, Sattari, S., Hossain, M. M., Komatsuzaki, T. An Information-theoretic approach toward identifying the leader(s) and aggregation place in Dictyostelium Discoideum colony. The 57th Annual meeting of the Biophysical Society of Japan (BSJ2019), Miyazaki, Japan.
6. U.S. Basak, S. Sattari, S. Nicholson, M. Toda, J. Green, T. Komatsuzaki. A leadership-based phase transition in a flocking model with activated and un-activated agents. 57th Annual Meeting of the Biophysical Society of Japan. Seagaia Convention Center, Miyazaki Japan. 25 September 2019.
7. U.S. Basak, S. Sattari, S. Nicholson, J. Green, M. Toda, T. Komatsuzaki. A sandbox model system for understanding leadership in collective motion. Study group, theory and experiment, 19th RIES-HOKUDAI International Symposium. Jozankei View Hotel, Sapporo, Japan. 11 December 2018.

Affiliated Societies

- (i) Biophysical Society of Japan (Member no.: 8693)
- (ii) Society of Industrial and Applied Mathematics
- (iii) Bangladesh Mathematical Society (BMS), Life member no.: (AA-967)

Grants Awarded

1. Financial Grants for Research Projects provided by Pabna University of Science and Technology (2015-2016 (Tk. 80,000 (approx. \$800)), 2021-2022 (Tk. 120,000 (approx. \$1200)) , and 2022-2023 (Tk. 130,000 (approx. \$1300))).
2. Research Grant by University Grants Commission of Bangladesh for the fiscal year 2022-23 (Tk. 300,000 (approx. \$3000)).

References

Prof. Tamiki Komatsuzaki
Department of Chemical Sciences
and Engineering Materials,
Hokkaido University,
Sapporo 060-0812, Japan.
☎ +81(11) 706 8434
✉ tamiki@es.hokudai.ac.jp

Prof. Kazuki Horikawa
Division of Bio-imaging,
Advanced Research Promotion Center,
Tokushima University
Tokushima 770-8503, Japan.
☎ +81-88-633-7692
✉ horikawa.kazuki@tokushima-u.ac.jp

Prof. Mikito Toda
Department of Physics,
Nara Women's University,
Nara 630-8506, Japan.
☎ +81-80-1444-4019
✉ toda@ki-rin.phys.nara-wu.ac.jp