



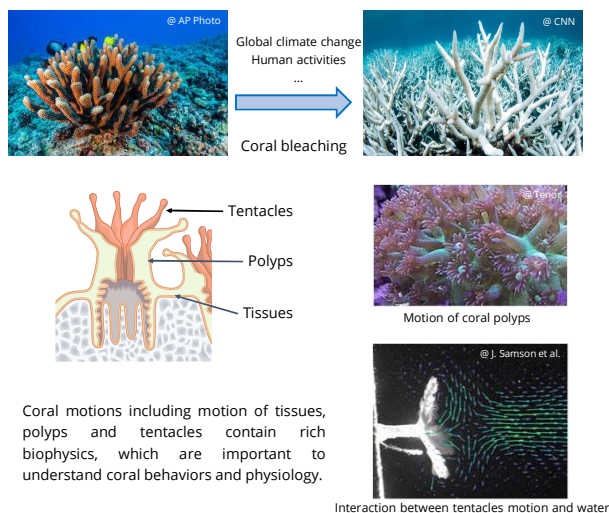
EXPLORATION OF CORAL BEHAVIORS VIA CORAL MOTIONS

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Introduction and Motivation



Challenges and Our Solutions

Challenges to characterize and analyze coral spatiotemporal dynamics

- Advanced experimental measurement

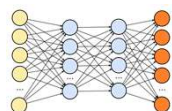
Imaging equipment



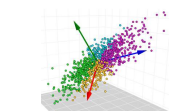
Image processing techniques

- Digital image correlation
- Particle image velocimetry
- Optical flow
- Particle tracing algorithm
- ...

- Proper modelling techniques

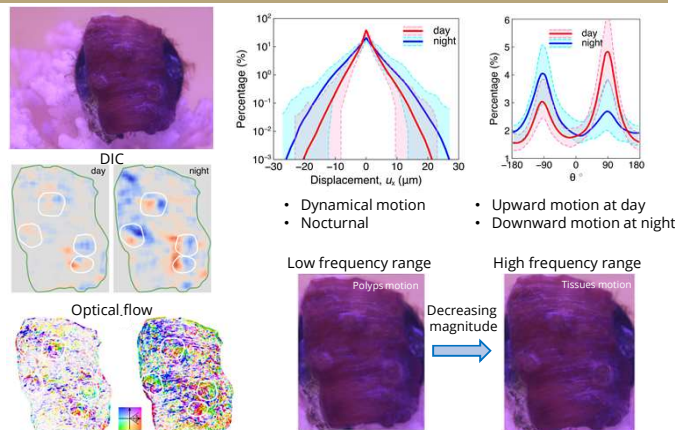


Neural network

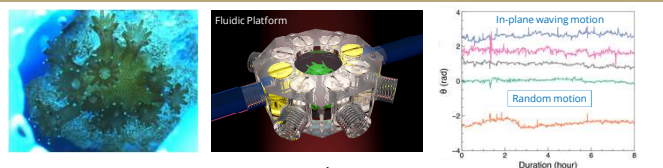


Dimensionality reduction

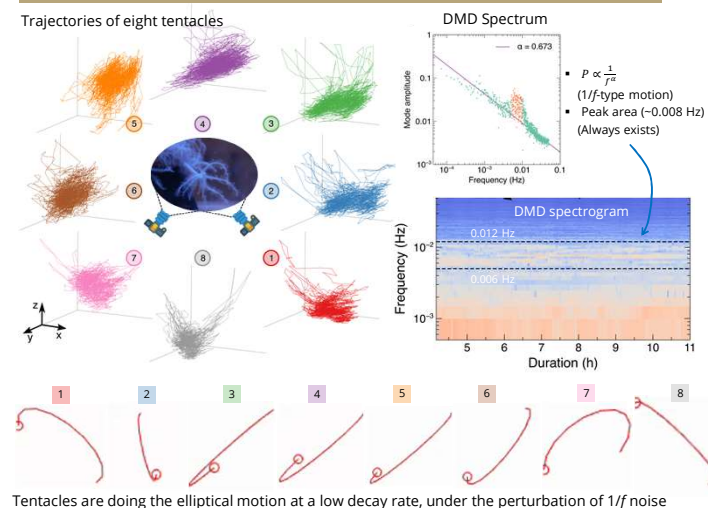
Motion of Coral Tissues^[1]



Motion of Coral Polyps^[2]



Motion of Coral Tentacles^[3]



Conclusion and Future work

Combining experimental observation, numerical analysis and theoretical modelling

- Visualized and quantified the **subtle motion** of coral tissues
- Discovered the **correlated fractional Brownian motion** of coral polyps
- Characterized the **1/f-type and elliptical motion** of coral tentacles
- Explored the effect of **environmental conditions** to coral motions

- Coral bleaching modelling by dynamic mode decomposition
- The application of DMD on mechanical systems
 - Wave propagation in topological metamaterials
 - Origami dynamics under different frequencies

Acknowledgments and References



- LEMS members.
- Prof. Nastassja Lewinski, Prof. Hollie Putnam, Prof. Judith Klein, Prof. Alex Gagnon.

- [1] S. Li et al, Digital image processing to detect subtle motion in stony coral, *Scientific Reports*, 2021
- [2] S. Li et al, Spatiotemporal dynamics of coral polyps in fluidic platform (under review in *Physical Review Applied*)
- [3] S. Li et al, 1/f-type motion and dynamic coherent patterns in coral tentacles motions (In preparation)