The Department of Physics and Astronomy and PHYS 492/692 presents…

From Birdsong to Data Science Applications in Physics: Research Contributions and Curriculum Development During my Sabbatical

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Abstract

During my sabbatical in the Spring of 2024, I was able to dedicate time to a couple of birdsong research projects. My first project focused mainly on the syntactic stability of zebra finch songs, investigating how the acquisition of an acoustic template influences vocal learning. We found that similar acoustic notes significantly affect the sequence of song elements, leading to increased syntactic variability in adult song motifs. In the second project, I explored the dynamic upper vocal tract articulations during zebra finch song, examining the acoustic effects and the auditory feedback effects. Our findings revealed that zebra finches dynamically and stereotypically adjust the oropharyngeal-esophageal cavity (OEC) during song generation, with complex relationships between OEC volume and acoustic features.

Additionally, I dedicated significant effort to developing a curriculum for a data science course designed for physics students. The course's goal is to give physics students essential skills in machine learning, neural networks, deep learning, time series analysis, topological data analysis, and other data science methods extensively used for physics research. This course prepares students to apply data-driven approaches in their future research and professional endeavors.

This sabbatical has been a valuable experience, allowing me to contribute to both scientific knowledge and educational advancement. I look forward to discussing these accomplishments and future plans in my sabbatical report.

Date: Thursday, April 3rd
Time: 4 pm
Location: Trafton C123