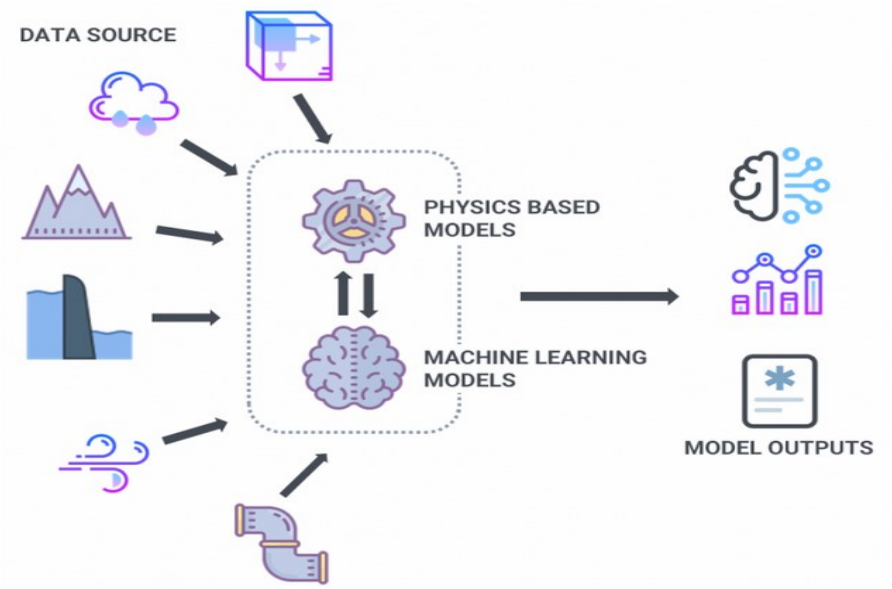
FAYETTEVILLE STATE UNIVERSITY

The Henry Eldridge Department of Mathematics and Computer Science



Seminar Series Fall 2020

DATE

September 24, 2020

TIME

2:30—3:30 pm

Zoom Meeting: **Click to Join**

Passcode: **980007**

Physics-Guided Machine Learning (PGML) and Applications

Abstract: Modeling complex systems with governing physical equations is difficult in many areas due to computational challenges. Current research in Artificial Intelligence and Machine Learning (AI/ML) shows evidence that data-driven learning algorithms can excel at tasks like classification and prediction where there is no known overarching mathematical model, e.g. in applications like computer vision and natural language processing. An emerging area of research suggests that scientific prediction can also benefit from data-driven AI/ML. However, this optimism is tempered by experimental challenges which indicate that exclusive reliance on historical data without inclusion of physical knowledge does not work well in practice. While at this early stage of research we do not yet have unifying frameworks for integration of physical knowledge with data-driven approaches, researchers working in different applications have discovered mathematical and computational tools that create effective solutions. Since machine learning is often used a "black/opaque box", explainable machine learning is emphasized in one set of applications in the natural sciences, and three core elements are discussed in this context, namely transparency, interpretability, and explainability. We will look at a structured overview of efforts to integrate traditional physics-based modeling approaches with state-of-the-art machine learning techniques. Application areas for these approaches will be summarized, and classes of methodologies used to construct physics-guided ML models and hybrid physics-ML frameworks will be described. Another taxonomy that serves as a classification framework considers the additional physical knowledge, its representation, and its integration into the machine learning pipeline. We will discuss some research projects that are currently active in our research group which use ideas in PGML.

PRESENTERS:

Dr. Sambit Bhattacharya

Professor, Department of Mathematics and Computer Science, FSU

For more information please contact:

Dr. Valentin Milanov

vmilanov@uncfsu.edu

Sci&Tech 408

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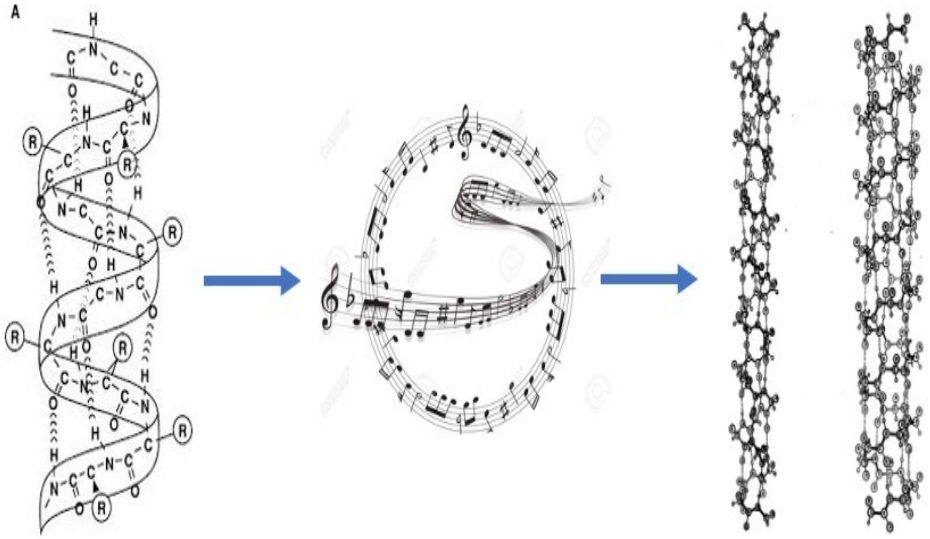

De novo protein design using Deep Learning and Music

Abstract: In this talk, we discuss a new approach to designing protein using ML and music. Amino acids form proteins and musical notes make up musical scores. Both proteins and music feature hierarchical structures. In this method, protein sequences and their structural information are translated into musical scores in which musical notes are mapped to amino acids. The secondary structure information and information about the chain length and distinct protein molecules are mapped into variations in musical note lengths and note velocities. A deep learning model is trained on the musical representation of alpha-helix rich proteins. The model is used to generate de novo musical scores and finally, the musical note information and chain lengths are mapped into sequences of amino acids. The method can be utilized to design novel protein materials with applications in biology, engineering, and medicine. A brief overview of amino acids and proteins will be covered in the talk.

Seminar Series
Fall 2020

DATE

October 22, 2020

TIME

2:30—3:30 pm

Zoom Meeting: **Click to Join**

Passcode: **980007**

PRESENTER

Dr. Chekad Sarami

Associate Professor

Department of Mathematics and Computer Science, FSU

For more information please contact:

Dr. Valentin Milanov

Sci&Tech 408

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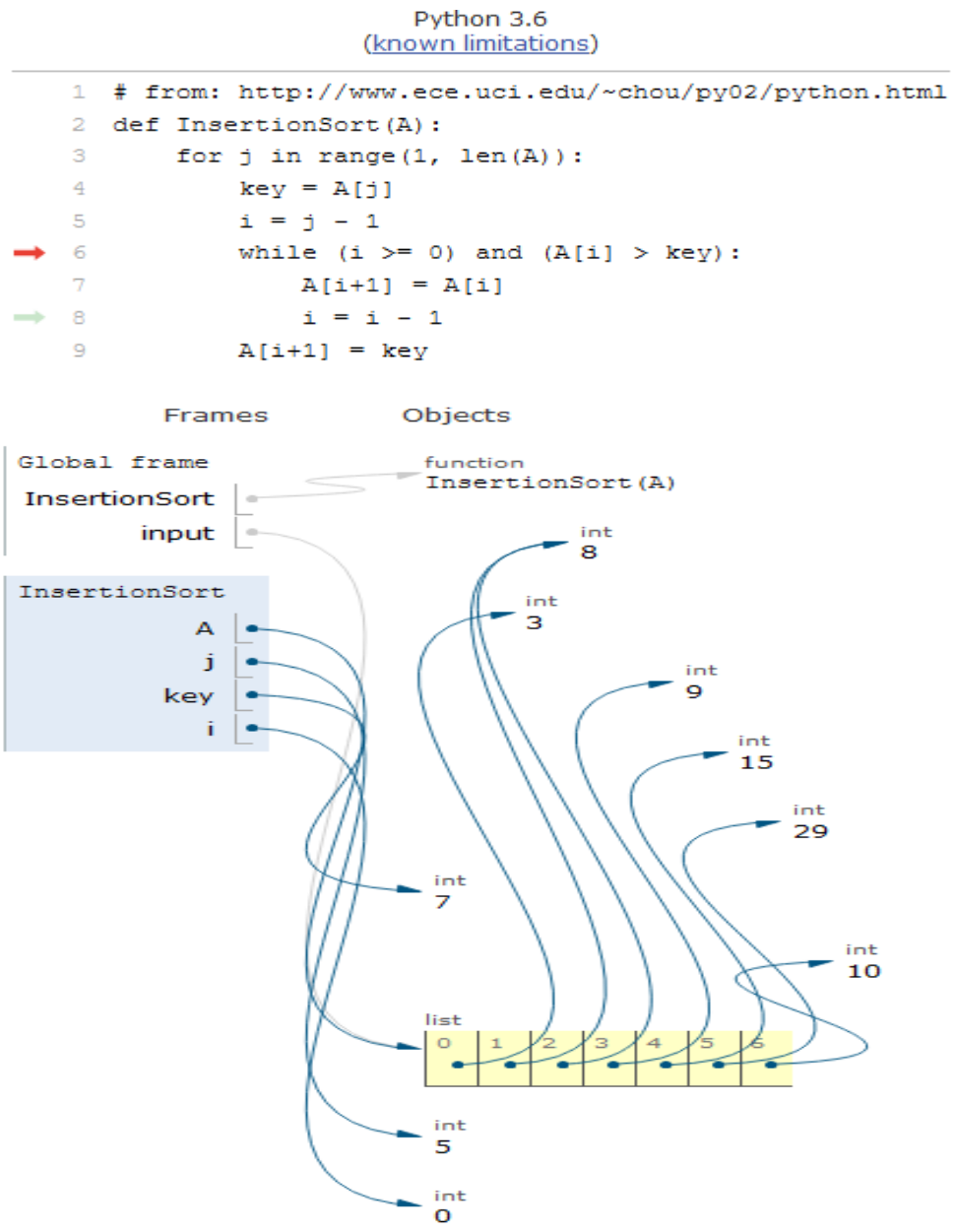

Using PythonTutor in the classroom

Abstract: PythonTutor is an open source visualization tool to gain insight in the execution of Python programs. In this talk, we will go through a few examples to demonstrate the use of PythonTutor in entry-level CSC programming classes.

Seminar Series
Spring 2021

DATE

February 19, 2021

TIME

2:00pm—3:00 pm

Zoom Meeting: **Click to Join**

Passcode: **980007**

PRESENTERS:

Dr. Albert Chan

Professor, Department of Mathematics and Computer Science, FSU

For more information please contact:

Dr. Valentin Milanov

vmilanov@uncfsu.edu

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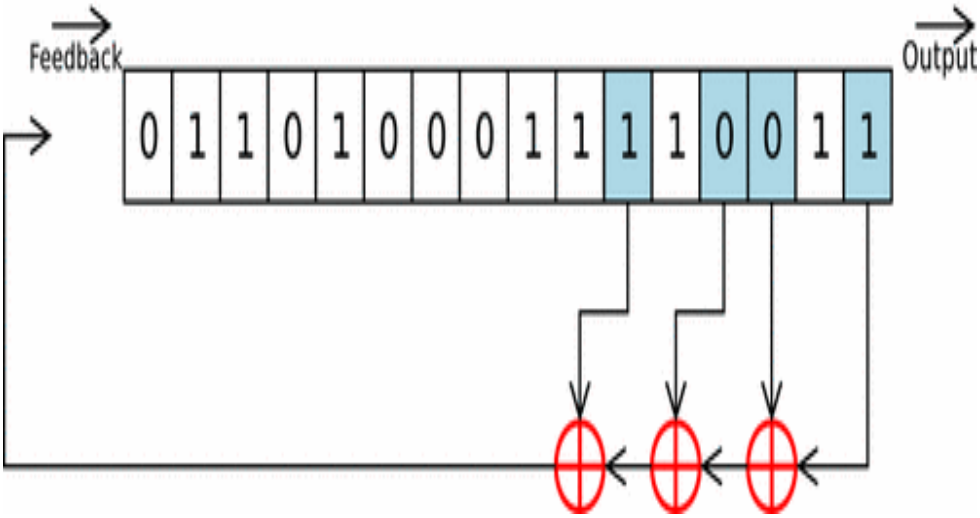

Matrix Approach for Maximum Period Linear Feedback Shift Register Stream Ciphers

Abstract: Maximum-period LFSRs are of interest in cryptography since they generate pseudo-random bit sequences that are large enough for them to be computationally secure using exhaustive search methods. A maximum-period LFSR has better linear complexity and satisfies the Golomb randomness postulates, and the autocorrelation function has two values only. The number of maximum-period LFSRs of degree grows super exponentially requiring multiprocessor computing systems. An attempt to develop matrix computing constructs for generating maximum-length LFSRs using commodity systems will be presented.

Seminar Series
Spring 2021

DATE

March 12, 2021

TIME

1:00—2:00 pm

Zoom Meeting: **Click to Join**

Passcode: **980007**

PRESENTERS:

Dr. Daniel Okunbor, Professor, Department of Mathematics and Computer Science, FSU

For more information please contact:

Dr. Valentin Milanov

vmilanov@uncfsu.edu

SCITECH 408

910-672-2202

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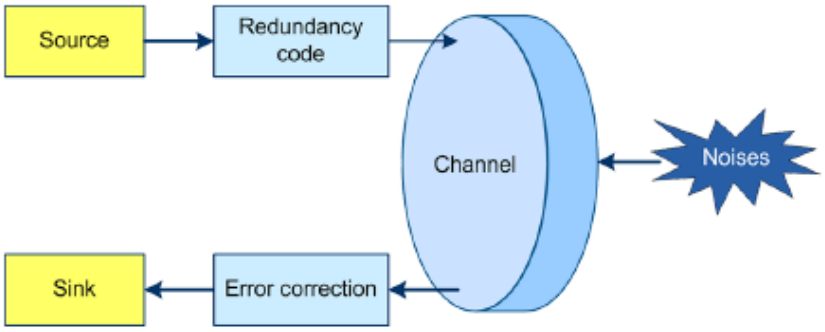

Seminar Series
Spring 2021

DATE

March 19, 2021

TIME

2:00pm—3:00 pm

Zoom Meeting: **Click to Join**

Passcode: **980007**

Eigenvector Approach to Split Weight Enumerators of Self-Dual Error-Correcting Codes

Abstract: The error-correcting properties of a linear block code depend on its weight distribution. It is well known that the weight enumerators of self-dual codes satisfy the Mac Williams identities. We interpret these weight enumerators as eigenvectors of Krawtchouk matrices. Split weight enumerators of self-dual codes are eigenvectors of Kronecker products of Krawtchouk matrices. We use computer algebra system Magma to determine the **10+10+4** split weight enumerator of a **[24,12,10]** Hermitian self-dual code over a finite field with four elements. We use it to show the nonexistence of this code. This result was first proved by Lam and Pless in 1990 using a long exhaustive computer search.

PRESENTERS:

Dr. Vassil Yorgov

Professor, Department of Mathematics and Computer Science, FSU

For more information please contact:

Dr. Valentin Milanov

vmilanov@uncfsu.edu

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FAYETTEVILLE STATE UNIVERSITY

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Poetry and Natural Language Processing

Abstract: Poetry recently attracted linguistic investigations and natural language processing researchers. Unlike ordinary language, poetic language, as creative use of language naturally disobeys the semantics and syntactical rules. In this talk, an overview of NLP techniques and tools used to generate, classify, and study the semantics of corpora of poetry will be presented. Utilizing machine learning, we can generate poems with rhythm and rhyme like poems of a human poet. We use TensorFlow and the Natural Language Toolkit (NLTK) to train a deep learning model and generate lines of *pseudo-poems*.

Seminar Series
Spring 2021

DATE

April 9, 2021

TIME

2:00—3:00 pm

Zoom Meeting: **Click to Join**

Passcode: **980007**

PRESENTER

Dr. Chekad Sarami

Associate Professor

Department of Mathematics and Computer Science, FSU

For more information please contact:

Dr. Valentin Milanov

SciTech 408

The Henry Eldridge Department of Mathematics and Computer Science

Seminar Series Spring 2021

Keeping up with the Virtual Instruction

April 16, 2021 TIME 2:00—3:00 pm

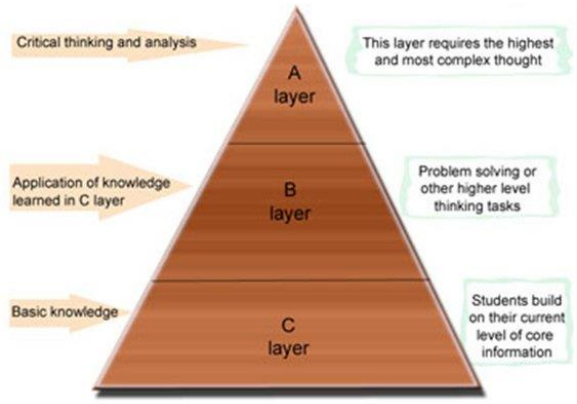
Zoom Meeting: Click to Join

Passcode: 980007

On a layered curriculum course redesign for a small online class

Dr. Nicoleta Bila

Layered Curriculum is a teaching method for differentiating instruction that incorporates students' varied learning styles. The 3-layer model encourages complex thinking and holds students highly accountable for their learning. I will present a redesign of the course Math 260 (Foundations of Mathematics) by using the 3-layer model. This course redesign is supported by the S4 program at FSU.



Using Corel VideoStudio for online learning

Dr. Yufang Bao

I will share my experience of using video editing software Corel VideoStudio for editing class video recordings to improve student learning. Often the recorded class videos need to be trimmed, cut, split, and more improvements, before sharing it with students in online or online virtual classes. This software provides convenience tools.

For more information please contact: Dr. Valentin Milanov

vmilanov@uncfsu.edu

MCS Series

The Benefits of Flip Learning and its Effect on STEM at FSU

Dr. Lynn Holmes Miles

Flip Learning: The new teaching pedagogy. How we use space, time, and activity in course design. Transitioning from a surface learning approach to a deep learning approach.

APRIL 30, 2021
10 AM – 11 AM

Zoom Meeting: Click to Join

Passcode: 980007