

James Madison University

Shenandoah Undergraduate

Mathematics and Statistics Conference

Virtual SUMS 2021 – Saturday, December 4, 2021



Opening Speaker:
Karen Lange, Wellesley College

Climbing (or Finding Paths) through Trees: Computing the difficulty of mathematical problems

You can make a simple family tree by starting with a person at the root and then adding two branches for her parents, and then adding two branches for the parents of each of her two parents, and so on. Such a family tree is an example of a binary tree because each level of the tree has at most two branches. We'll see that every binary tree with infinitely many nodes has an infinite path; this result is called Weak König's Lemma. But just because we know a path exists, doesn't mean we can find it. Given Weak König's Lemma, it's natural to ask whether we can compute a path through a given binary tree with infinitely many nodes. It turns out the answer to this "Path Problem" is "no", so we say that the problem is not "computable". But then what exactly is the computational power of this Path Problem?

Using the Path Problem as a test case, we will explore the key ideas behind taking a "computable" perspective on mathematics (over an "existence" one) and describe an approach for measuring the computational power of mathematical problems. We'll see that the computational power of problems varies widely and studying problems' power helps to illuminate what really makes problems "tick".

This talk will highlight ideas from graph theory, theoretical computer science, and logic, but no background in any of these subjects is necessary.

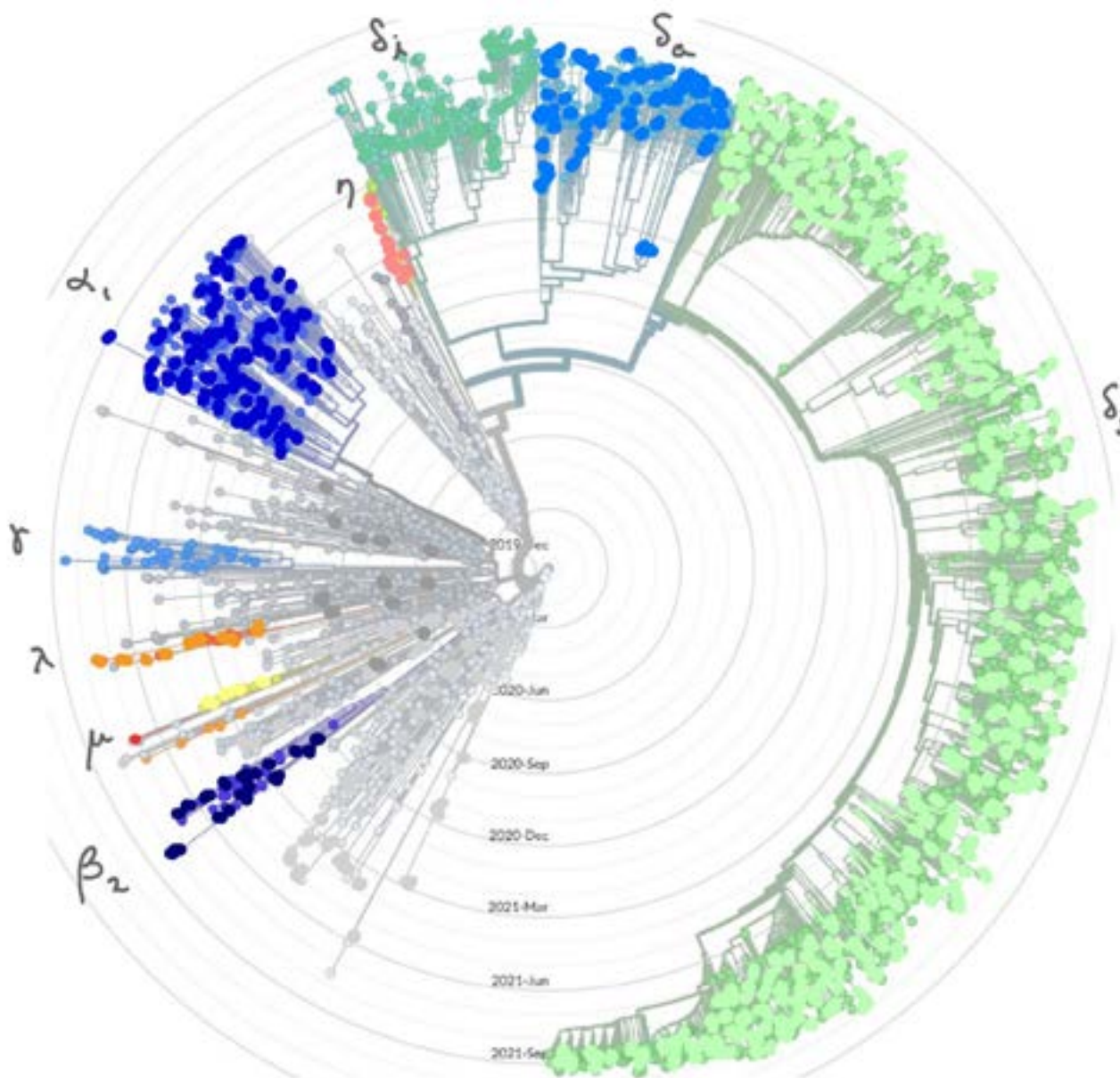


Image: www.gisaid.org/phylogenetics/global/nextstrain/

Demystifying Data Science

The Data Science Pipeline - far more than a set of AI/ML algorithms. The first questions we ask, the early decisions we make, the final use and interpretation of our results - all of these play a crucial role when leveraging data-informed decision making for any problem. In this talk, we'll unpack what data science is with an emphasis on thinking about the entire data life cycle. We'll explore how data science is being used to tackle problems in fields like transportation logistics, retail, travel, professional sports, as well as take an insider's look at modeling influenza and the COVID-19 pandemic. We'll also focus on communication and collaboration because, at its heart, data science starts and ends with people.



Closing Speaker:
Rebecca Nugent, Carnegie Mellon University

[Register](#) and get a link now to upload a presentation by **November 27**.

[General registration](#) active through **December 4**.

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