

**Thesis Portfolio**

**wtCNN: Wavelet-Transform Convolutional Neural Networks for Identifying Regime Shifts in Ecological Timeseries**

(Technical Topic)

**Grindr Design, Leadership, and Practice: Understanding Responsibility with Care Ethics**

(STS Topic)

By

Ryan Taylor

8 May 2020

B.S. in Engineering Science

B.A. in Physics

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Signed: *Ryan Taylor*

Approved: \_\_\_\_\_ Date: \_\_\_\_\_

Benjamin Laugelli, Department of Engineering and Society

Approved: \_\_\_\_\_ Date: \_\_\_\_\_

Jonathan Walter, Department of Environmental Science

## **Table of Contents**

Socio-technical Synthesis

Wavelet-based Neural Networks for Predicting and Identifying Ecological Regime Shifts

Grindr Design, Leadership, and Practice: Understanding Responsibility with Care Ethics

Prospectus

## **Sociotechnical Synthesis**

What connected my technical and STS research was the idea of responsible software design through consideration of user configuration and data transparency. User configuration is the idea that the user-technology relationship is dynamic and co-constructed. The users decide how to use a technology based on both its design and their own needs. Data transparency means that, when information is drawn from an individual or group, they know how the data is being used, at least. Data transparency can also mean obtaining consent from those providing the data before storing, processing, or sharing the data. These concepts were pivotal considerations in both my technical work and STS research. In the former, I incorporated those concepts into the design of an R package, the ethical implementation of which relies on responsible data gathering. In the latter, I considered the ethical implications of the app Grindr not responsibly considering user configuration and exploiting the data of their users.

In my technical work, I designed an R package (wtCNN) that attempts to identify and forecast ecological regime shifts in aquatic ecosystems. These regime shifts mark large changes in the distribution of features like phytoplankton and nutrients. Harmful algal blooms (HAB), which cost billions every year, is a particular regime shift that we modeled in our research. We worked simulated timeseries data and combined two methods of analysis: wavelet transformations (WTs) and convolutional neural networks (CNNs). When combined, the package was able to identify regime shifts in simulated timeseries with near 100% accuracy. However, our forecasting technique requires improvement because of the low accuracy we obtained during its testing. Our R package can be applied to ecological and scientific fields that need to classify timeseries with many different features.

In my STS research, I argue that Grindr failed to implement effective care to its users by not considering the diversity of its user base and being opaque with how they used their data. Grindr is a location-based sociosexual messaging app primarily used by people in the LGBTQ community. Applying the lens of care ethics, I argue that Grindr designed and regulated its app in such a way as to restrict its use to cis gay men and exclude trans men and women. This was despite the fact that trans individuals used the app in similar ways to gay men and benefitted from the community it provided. Additionally, I argue that Grindr exploited user data, potentially exposing marginalized groups to greater threat, like those who are identified as HIV positive on the app. Combined with an analysis of corporate attitudes, I assert that Grindr is and was neither being responsible with its software design nor implementing an effective attitude of care.

Seeing how software was designed irresponsibly with respect to its users in the case of Grindr urged me to consider how people might use my R package. Because of the broad user applications, we did not make the package specific to aquatic ecosystems. In this way we considered the potential ways users could configure the technology beyond the scope of our research. There are further considerations around data ethics when our project is applied. Just as Grindr should have obtained informed consent before sharing user data, gathering ecological data requires the consent of the relevant community or landowner. The Forest Inventory and Analysis National Program is one such organization promoting ethical ecological data use. This informed my analysis of Grindr, which could benefit from similar oversight. Conducting both technical and STS research at the same time was mutually beneficial, providing context and perspective on the questions and challenges within each task.