Environmental Machine Learning in Multispecies Agency: A Case Study of *Random Forests*

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Abstract

The recent tendency in researching multispecies is through the interdisciplinary practice of creative art and technology. By applying machine learning as a tool for studying multispecies dynamics within an artistic context, it is possible to create an ecological narrative of other species. This text analyses the *Random Forests* research project as a case study for how Environmental Machine Learning (EML) generates such a narrative and questions how EML can help humans to better understanding multispecies entities and enable them to pursue more ecologically ethical multispecies relationships.

Introduction

Questioning the human-focused idea of species hierarchy is one of the most important topics in understanding Anthropocentrism. The concept of 'Multispecies' emphasises the idea that humans as a species are "rooted" in the ecosystem (Morris 2014, 51; Aisher and Damodaran 2016, 2), and serves as a fundamental orientation from which explore the world of the post-Anthropocene. Since 2019, I have been researching plant-based multispecies relationships through my cinematic practice. The main research objectives are challenging the human-centric gaze of the camera lens in filmmaking, and visualising plants' way of seeing the world. In exploring plant-based perspectives, I seek alternative methods to connect humans within multispecies dynamics to overcome the anthropocentric perspective in artistic practice. Within the course of my research, I discovered that the application of machine learning (ML) to eco-art opens up new potential for multispecies interactions within contemporary ecological agencies. *Random Forests* brings ML to bear upon the ecological dimension and inspires a fresh mode of learning from the environment.

Background: Environmental Machine Learning (EML)

ML utilises algorithms that can predict and make a decision from collected data. Ecology and natural science employ ML to process data collected from surrounding environments, which are non-linear, complex and multidimensional (Thessen 2016). Environmental Machine Learning (EML) interacts with these ecological data and trains algorithms with it. Tree-based ML methods which include Decision Tree, Classification Tree, and Regression Tree are good examples of EML models which combine basic ML tasks with plant data (Olden et al. 2008; Hsieh 2009; Kampichler et al. 2010; Thessen 2016). The Random Forest algorithm builds upon the Decision Tree model to analyse a large quantity of data with a higher individual accuracy of trees (Thessen 2016; Karelse 2018). Other ML models such as Genetic Algorithm, Fuzzy Inference System and Bayesian Methods are adopted in ecology and natural science to research natural conservation, species distribution, environmental sensing and so on (Thessen 2016).

Case Study: *Random Forests* by Theun Karelse

The technical basis of Theun Karelse's artistic research, *Random Forest*, is EML. Prior to this project, Karelse conducted two projects *Augmented Ecology* (2014) and *Machine Wilderness* (2015) that explored the

multispecies relations in the ecosystem with augmented reality and machine- (living) organism interactions. He expanded his research into *Environmental Machine Learning* (2018) to explore the possibility of EML as an implication for multispecies relations as a whole. Karelse realised that the field of artificial intelligence generally did not acknowledge ecological elements and non-human species other than animals and plants. Furthermore, he pointed out ML does not have a neutral perspective since the training sets are created from what humans have pre-selected. Thus, in *Random Forests,* Karelse combined an Artificial Neural Network model and Decision Tree model to process and analyse environmental data, with the hope that the scope of his algorithm can include both biotic and abiotic organisms or a '"world-view"' that relates to "umwelt"' in his words (Karelse 2018). Karelse conducted four sessions of fieldwork to introduce EML to the "real-world terrain" and trained the algorithm to learn from the environment (Karelse 2018). As a result, Karelse questions whether the natural surroundings and ecosystem should be involved in machine learning training to overcome the anthropocentric prepositioning in possible multispecies and computer interaction. Karelse's research demonstrates the need to consider "ecological correctness" in the filmmaking process without species hierarchy and simultaneously overcomes the limitation of anthropocentrism. This principle is central to my own practice-based research, which tries to avoid human-centric gaze but to learn from plants' perspective.

Conclusion

Technological implications take an important role in working with art and multispecies. Utilising machine learning in artistic practice enables artists not only to collect environmental data and shape them into different forms but also to practice multispecies-computer interaction and participate in the ecological community (Rieger and Bolinski 2020). Stephan Rieger and Ina Bolinski explain that human species can take a "multispecies turn" and move beyond human centered perspectives to encompass multispecies and non-human agencies in the surrounding environment by collaborating with technologies in various fields including art and ecology (Rieger and Bolinski 2020). The long history of the Anthropocene has unbalanced the holistic environment of multispecies relationships. Researching the ecological engagement of Machine Learning supports the ethical participation of A.I in multispecies relationships.

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Biography

Park Ji Yun is an artist and researcher. She is currently conducting her doctoral research with orchids, which considers eco-cinema as a method to investigate multispecies relationships of epiphytic plants. Her interests include urban ecology, more-than-humans and plant sociality.