CURRICULUM VITAE

Lance Legel

Chief Executive Officer of Ecodash.ai

Born August 2, 1988 in *Miami*, *Florida*

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ACADEMIA

Columbia University, *Master of Science coursework in Computer Science* 2013-2015

Concentration in machine learning with 3 graduate courses completed:

> Machine Learning taught by Tony Jebara

>> Generative Probabilistic Models, Regression, Classification, Unsupervised Learning

> Computational Learning Theory taught by Rocco Servedio

>> Paper: *Probabilistic Computational Learning Models for Evolutionary Dynamics*

> Deep Learning for Computer Vision and Natural Language Processing taught by Liangliang Cao

>> Paper: *Distributed Optimization of Deep Reinforcement Learning Agents on Supercomputers*

Awarded for programming projects in machine learning:

> *Most Technically Challenging Hack Award* at Columbia DevFest 2014 for *VisiWiki*

> *1st Place Analysis Award* at New York City Data Hackathon 2015 for *Clarity*

University of Colorado Boulder, *Master of Science in Engineering & Applied Science* 2011-2013

Published Master of Science thesis on Deep Neural Networks:

> Thesis: *Parallelized Deep Neural Networks for Distributed Intelligent Systems*

> Published deep neural network classification experiments based on computational neuroscience

> Research funded by US Department of Defense (ONR)

> Advisor: Randall O'Reilly, protégé of Geoffrey Hinton (2024 Nobel Physics Laureate)

> Referenced 103 publications across math, statistics, physics, biology, and computer science

3.79 GPA from 18 interdisciplinary science & engineering courses

3.83 GPA from 7 computer science courses:

> Computer Systems, Algorithms, Data Structures, Discrete Structures, Data Mining

> Software Engineering, Advanced Robotics

>> Paper: *Autonomous Robotic 3D Scanning and Modeling of Plant Growth*

University of Florida, *Bachelor of Arts in Physics* 2007-2010

Published Bachelor of Arts thesis on Planetary Formation with *Summa Cum Laude* honors:

> Thesis: *Planetary Formation Modeling via N-Body Relativistic Gravity Simulation*

> Published computational physics models of Einstein's gravity equations for planetary evolution
> Thesis research funded by NASA and National Science Foundation
> Highlight: NASA + NSF REU *Astrobiology* summer research program
> Advisor: Eric B. Ford, Distinguished Professor, *Hubble Fellow at Harvard-Smithsonian Center*

3.65 GPA in final 2 years of study with 3.48 cumulative GPA from 60 courses
Completed 60 courses, featuring 28 courses in natural sciences, including:
> Analytical Physics with Laboratories, Thermal Physics, Mechanics, Electromagnetism
> Modern Physics, Quantum Physics, Particle Physics, Astrophysics, Chemistry with Laboratories
>> Paper: *The Dark Universe: Modeling the Physics of Non-Baryonic Matter and Energy*
> Planetary Geology, Global Biodiversity, Molecular Biology, Space Biology
> Biophysics
>> Advanced graduate-level course taught across Physics & Biology Departments
>> Modeling of complex biological processes through fundamental physics
>> Paper: *Synaptic Encoding of Neural Memory in Biological Brains*
>> Research in biological neural networks led to MS thesis research in AI

Hosted a *Life in the Universe* forum as president of the Undergraduate Astrophysics Society
Founded a public policy research group called *The Dynamo* focused on technology and sustainability
Graduating award from University of Florida's College of Liberal Arts & Sciences:
> *Outstanding Leadership Award*

INDUSTRY

Ecodash.ai, *CEO & Lead Scientist* 2023-*Now*

Developing an AI-powered ecological modeling & native planting design platform
Servicing 16 landscape architects in Florida on projects between 0.25 to 500 acres
Leading delivery of client-facing 3D ecological site surveying & modeling services:
>> *Aerial & ground 3D LiDAR + RTK photography with ~1 cm (x,y,z) geospatial precision*
>> *Soil sampling of landscapes & lab testing of pH, N, P, K, organic matter*
>> *Sun, wind, flood, drought, & fire exposure modeling across ecological niches*
>> *Geospatial labeling of 3D digital twin by environmental scientists & landscape designers*

Leading the development of software tools for native planting design & procurement:
>> *Modeling key properties of native plants to assist designers with selection and placement*
>> *Equipping planting designers with tools to filter plants by ecological niches & function*
>> *Increasing clarity for designers & clients through 3D rendering of sites & planting designs*
>> *Offering commercially-available native plant pallettes from local nursery partners*

Leading the development of *DeepEarth* open source AI model for landscape ecology:
>> DeepEarth is a self-supervised multimodal deep learning model for simulating ecosystems
>> Prototyping first model for inference of plant-pollinator biotic interactions in Central Florida
>> Leading NSF I-GUIDE Workshop: *Geospatial AI and Innovation for Sustainability Solutions*
>> Team Leader for NSF Summer School: *Spatial AI for Extreme Events and Disaster Resilience*

>> Pre-Print 1: *Ecology Foundation Model for Global Biogeography and Ecophysiology*
>> Pre-Print 2: *Inductive Neural Networks for Ecology*
>> Pre-Print 3: *DeepEarth: Geospatial Deep Simulator of Earth's Ecosystems at Landscape Scale*

Highlight: University of Florida faculty seminar presentation on *Ecological Intelligence*
Highlight: University of Florida workshop on *Intelligent Cultivation of Urban Ecosystems*
Highlight: 2024 *Game Changers* Award by the American Society of Landscape Architects
Pioneering research and development of AI for global ecology

> Research Advisors & Collaborators:

>> *Barnabas Daru*	Stanford University Professor, Biogeography and Ecology
>> *Alexandra Konings*	Stanford University Professor, Earth Sciences
>> *Daniel Neamati*	Stanford University PhD Student, Geospatial Neural Radiance Fields
>> *Mira Partha*	Stanford University PhD Student, Geospatial Neural Radiance Fields
>> *Pamela Soltis*	University of Florida Professor, Biodiversity
>> *Douglas Soltis*	University of Florida Professor, Plant Biology
>> *Makenzie Mabry*	University of Florida Postdoctoral Scholar, Biodiversity Genomics
>> *Robert Guralnick*	University of Florida Professor, Biodiversity Informatics
>> *Ryan Klein*	University of Florida Professor, Environmental Horticulture
>> *Zachary Brym*	University of Florida Professor, Agroecology
>> *Gail Hansen*	University of Florida Professor, Sustainable Landscape Design
>> *Teagan Young*	University of Florida Postdoctoral Scholar, Environmental Horticulture
>> *Jorg Peters*	University of Florida Professor, Computer Science
>> *David Althoff*	Syracuse University Professor, Evolutionary Ecoclogy
>> *Kari Segraves*	Syracuse University Professor, Evolutionary Ecology
>> *Mayra Vidal*	University of Massachusetts Boston Professor, Species Interactions

> P.I. on full proposal invited by NSF SBIR/STTR Agricultural Technologies program officer
>> Proposal: *Geospatial Technology for Ecological Planting Design*
>> Up to $2 million for scientific modeling of ecophysiology at microclimate / community scale
>> Research focuses on site surveying technologies coupled with ecophysiological modeling

> Researched and developed global geographic native habitat models:
>> Indexed 1899 and earlier biodiversity records for 90,800 plant species worldwide
>> Pre-computed geohash precision 5 global indexing of native habitats for instant look-up
>> Indexed 10,000 publicly available native plant habitat models of *Daru et al.*

> Built website to automatically support discovery of native plants worldwide:
>> Indexed over 100,000 geographic URLs, *e.g. https://ecodash.ai/geo/za/06/johannesburg*
>> Launched search engine optimization (SEO) for worldwide discovery
>> Ecodash.ai has received over 100,000 unique visitors from 500 cities worldwide

> Researched and developed AI for functional plant trait inference from online literature:
>> Downloaded 860,000 web pages from top Google Search results on 90,800 plant species
>> Developed a *Semantic Retrieval Augmented Generation* for interpreting web data
>> Developed plant trait ontology with 66 parameters and 370 total possible values
>> Generated custom deep neural network embeddings for every parameter and every species
>> Validated AI model as 99.6% accurate in making 709 parameter claims for 27 plant species
>> Demo of GPT-4 model application for trait inference: *https://ecodash.ai/parameterization.txt*

>> Produced via RAG over 1 million successful plant inferences from 6 million GPT-4 queries
>> Built web user interface for instant filtering of native plants by over 300 plant traits

3co.ai, *CEO & Chief Technology Officer* 2017-*Now*

Co-founded 3D computer vision company with PhD computer scientist, Robert Cohn
Developed in 2017 a visual classification system for plants with 97% accuracy on 10,000 species
Developed in 2018 an augmented reality 3D e-commerce platform for the garden industry
Participated in two startup accelerator programs:
> *Let It Grow* horticultural technology incubator funded by Royal FloraHolland in Amsterdam
> *Techstars* technology accelerator in London, less than 1% acceptance rate
Raised $1 million in cash and computing resources including from Google, Amazon, Microsoft
Patented inventions in deep learning for computer vision, 3D graphics, 3D scanning, and robotics
Developed state-of-the-art techniques for photorealistic 3D reconstruction with neural radiance fields
Developed neural networks for 3D structural plant modeling, based on laser-scanned data
Researched and developed computer vision neural networks for geospatial plant classification
Published open source code libraries for 3D computer vision: *https://github.com/legel/3co*

PRESENTATIONS, PAPERS, PATENTS, & PROJECTS

2010 Planetary Formation Modeling via N-Body Relativistic Gravity Simulation, *Bachelor's Thesis*
2010 The Dark Universe: Modeling the Physics of Non-Baryonic Matter and Energy, *Physics R&D*
2010 Synaptic Encoding of Neural Memory in Biological Brains, *Biophysics R&D*
2011 The Future of Smart Computing Systems, *Report on AI published at TheDynamo.org*
2012 Autonomous Vehicle Policy, *Report on AI published at TheDynamo.org*
2013 Autonomous Robotic 3D Scanning and Modeling of Plant Growth, *Robotics R&D*
2013 Parallelized Deep Neural Networks for Distributed Intelligent Systems, *Master of Science Thesis*
2013 Probabilistic Computational Learning Models for Evolutionary Dynamics, *AI R&D*
2014 Distributed Optimization of Deep Reinforcement Learning Agents on Supercomputers, *AI R&D*
2014 GitHub: VisiWiki, *Google DevFest 2014 Most Technically Challenging Hack Award from A16Z*
2015 GitHub: Clarity, *Awarded 1st Place, Machine Learning, at NYC Cornell Data Hackathon 2015*
2015 Deep Object Detection, *Presentation for Columbia University Deep Learning Course*
2015 3D Virtual Reality Sparked by Streaming Sentiment Analysis, *Project at Columbia University*
2015 AI for Discovering Job Skills, *Proposal for Fellowship Awarded from Ford Foundation*
2016 Making Sense of Everything with words2map, *Report on AI project with HackerNews coverage*
2016 GitHub: legel/words2map, *Python open source AI project with 300 stars*
2017 How to Invent the Future with AI, *Presentation for Second Home Lisboa*
2018 Nature & Naturalistic Gardens, *Presentation for Ignite Boulder*
2018 Planting the City with Tech, *Presentation for Workshop in Amsterdam on Green Cities*
2018 Augmented Reality App for Garden E-Commerce, *Project sponsored by Royal FloraHolland*
2019 GitHub: Physically-based Rendering for 3D Scanning Simulator, *Project for AI training with 3co*
2019 Differentiable Photonic Generator-Localizer, *United States Patent Filing*

2020 Autonomous LED-Powered Vertical Tropical Rainforest Garden*, Planting in Amsterdam*
2020 GitHub: Iris - Robotic 3D Scanning with Lasers*, Robotics machine invented for 3D modeling*
2021 Inverse Rendering with 3D Coordinate Measuring Machines, *United States Patent Filing*
2021 Deep Learning Visualization for Interactive Knowledge Discovery*, Demo video from AI project*
2022 Scaling 3D Photorealism*, Presentation to Khronos 3D Commerce Working Group*
2022 3D Capture Metadata in GLTF, *Presentation to Khronos 3D Commerce Working Group*
2022 3co Scales Augmented Reality Commerce with 3D Scanning*, Blog on Google Cloud*
2022 Computer Vision for Photorealistic 3D Modeling*, Presentation to Hop Labs AI R&D Tea*
2022 Depth-Supervised Multispectral Neural Radiance Fields for 3D Reconstruction, *R&D proposal*
2023 Computer Vision for Semantic Segmentation of Plants, *Demo of code through 3co*
2023 Intelligent Cultivation of Urban Ecosystems, *Led workshop at University of Florida*
2023 Computer Vision for 3D Modeling Nature*, Presentation at University of Florida workshop*
2023 AI + XR for Garden Design, *Presentation at University of Florida workshop*
2023 GitHub: Neural Radiance Fields with LIDAR from iPhone Pro*, Project through 3co with code*
2023 AI for Monitoring & Mitigation of Invasive Species*, University of Florida R&D proposal*
2023 GitHub: Fine-Tuning DinoV2 for Plant Species Classification*, Python open source notebook*
2023 Deep Learning for Plant Species Classification: 2017 and 2023, *Projects through 3co with code*
2023 Research & Technology Overview of 3co, *Presentation for NSF SBIR/STTR SeedFund Team*
2024 Ecological Landscaping Technology*, Presentation to Biodiversity Institute*
2024 Planting Design Technology*, Presentation to NSF SBIR/STTR Research Team*
2024 Intelligent Ecological Cultivation, *Florida Nursery Growers & Landscaping Association*
2024 Environmental Restoration Technology, *Presentation on Ecodash 2024-2026 mission*
2024 Ecological Intelligence, *University of Florida Environmental Horticulture Faculty Seminar*
2025 Natural Ecosystem Landscaping Platform, *Overview on native ecosystem restoration platform*
2025 Ecology Foundation Model, *R&D proposal for geospatial deep learning model of ecophysiology*
2025 Inductive Neural Networks for Ecology, *Deep learning model design of ecological simulation*
2025 DeepEarth: Geospatial Deep Simulator of Earth's Ecosystems at Landscape Scale, *Preview of AI*
2025 Ecological Site Surveying, *Demo of land mapping techniques for 3D ecological digital twin*
2025 Photorealistic 3D Modeling of Central Florida Native Plants, *GeoFusion + Gaussian Splatting*
2025 Earth Day Demo, *Demo of 3D ecological niche mapping with AI-powered planting design tools*
2025 Services for Sustainable Landscape Designers, *Overview of key technology services from Ecodash*
2025 Geospatial Simulation of Fire Ecology with DeepEarth, *NSF I-GUIDE 2025 Summer School plan*
2025 Firewise Landscaping Program for City of Berkeley, *Program designed for Fire Chief of Berkeley*

BIOSKETCH

Lance Legel | CEO & Lead Scientist at Ecodash, Inc.
NASA planetary physicist turned ecological AI entrepreneur. Pioneering new ecological science, technology, and design tools on a mission to maximize ecosystem services worldwide.

Leading development of AI for ecology through Ecodash.ai, with a focus on native planting design geotechnical services and software tools, which can help maximize ecological function and sustainability. Directing professional services for 3D ecological digital twin modeling of sites, including aerial & ground LiDAR + RTK photography, site soil sampling and soil chemistry testing especially for landscape design, and ecological niche modeling services partnered with university scientists. Serving award-winning ASLA landscape architects in Central Florida, to increase ecological intelligence and sustainability of land development industries. Partnered with leading native plant nurseries to integrate software for inventory management, growth contracting, and wholesale purchasing with AI planting design tools. Recognized by the American Society of Landscape Architects in 2024 with a *Game Changer* award.

Leading development of DeepEarth, an open source ecological AI foundation model for ecology pioneered primarily with scientists from Stanford University and University of Florida. Designed DeepEarth for flexible and extensible sub-meter deep encoding of geospatially, temporally, and ecologically distributed multi-modal datasets, to support biologists, geologists, and ecologists worldwide. Prototyping a DeepEarth model for prediction of native plant-pollinator interactions in Central Florida, in order to advise landscape design of the most biodiverse and ecologically vibrant pollinator gardens. Leading a NSF *Institute for Geospatial Understanding through an Integrative Discovery Environment* (I-GUIDE) DeepEarth workshop in Chicago at the 2025 Sustainability Research & Innovation Congress. Leading a NSF I-GUIDE Summer School program at UCAR in Boulder, Colorado to fine-tune DeepEarth for simulation of plant-fire ecohydrology.

Completed a Master of Science thesis on deep neural networks from the University of Colorado Boulder, published in 2013, funded by US Departments of Defense and Energy. The MS thesis was advised by Randall O'Reilly, who was previously directed by 2024 Nobel Physics Laureate, Geoffrey Hinton. Following the Master of Science, also completed coursework and research as a graduate student at Columbia University in the Department of Computer Science, including graduate computer science courses in machine learning, deep learning, and computational learning theory. As a student at Columbia University, also led multiple award-winning hackathon teams, including a 1st Place prize winning team in Machine Learning at the 2015 NYC Data Hackathon, in the headquarters of Google, sponsored by Cornell University. Prior to the Master of Science, completed a Bachelor of Arts from the University of Florida, graduating *Summa Cum Laude* with a degree in physics. While at the University of Florida, funded by NSF and NASA for research in planetary sciences and astrobiology.