

Outreach, Education, Diversity, and Synthesis
in
CompSustNet

Presentation to CompSust-2016: 4th International Conference
on Computational Sustainability

Douglas H. Fisher
Vanderbilt University

Director of Outreach, Education, Diversity, and Synthesis (OEDS)
for
CompSustNet

Supported by NSF Award # 1521672

Collaborative Research: CompSustNet: Expanding the Horizons of Computational Sustainability

OEDS Team Goals

- Aware of activities in these areas across CompSustNet, proactive in developing and coordinating some of these
- Able to discuss CompSustNet activities, including research, broadly NSF and others
- Develop strategies for evaluating broader impacts, implenting them in selected cases
- Facilitate growing the research and growing the researchers, in depth and breadth

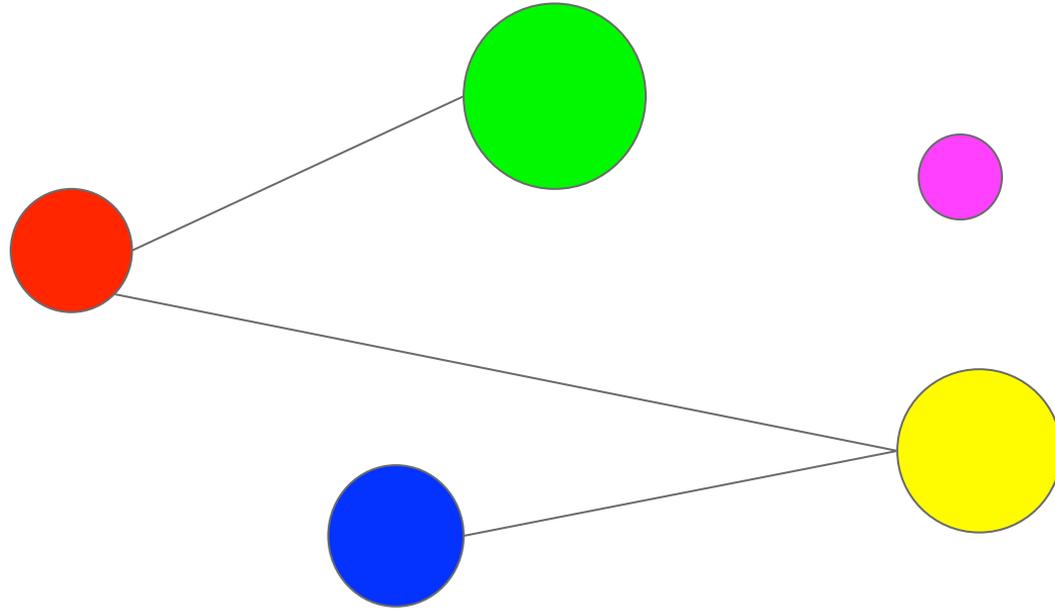
Who else is involved (if you want to be, contact me!)

- Zimei Bian, Vanderbilt University
- Selina Chen, Vanderbilt University
- Rich Bernstein, Cornell University
- Carla Gomes, Cornell University
- Christianne McMillan, Cornell University

Collecting data and feedback (see <http://blog.computational-sustainability.org>)

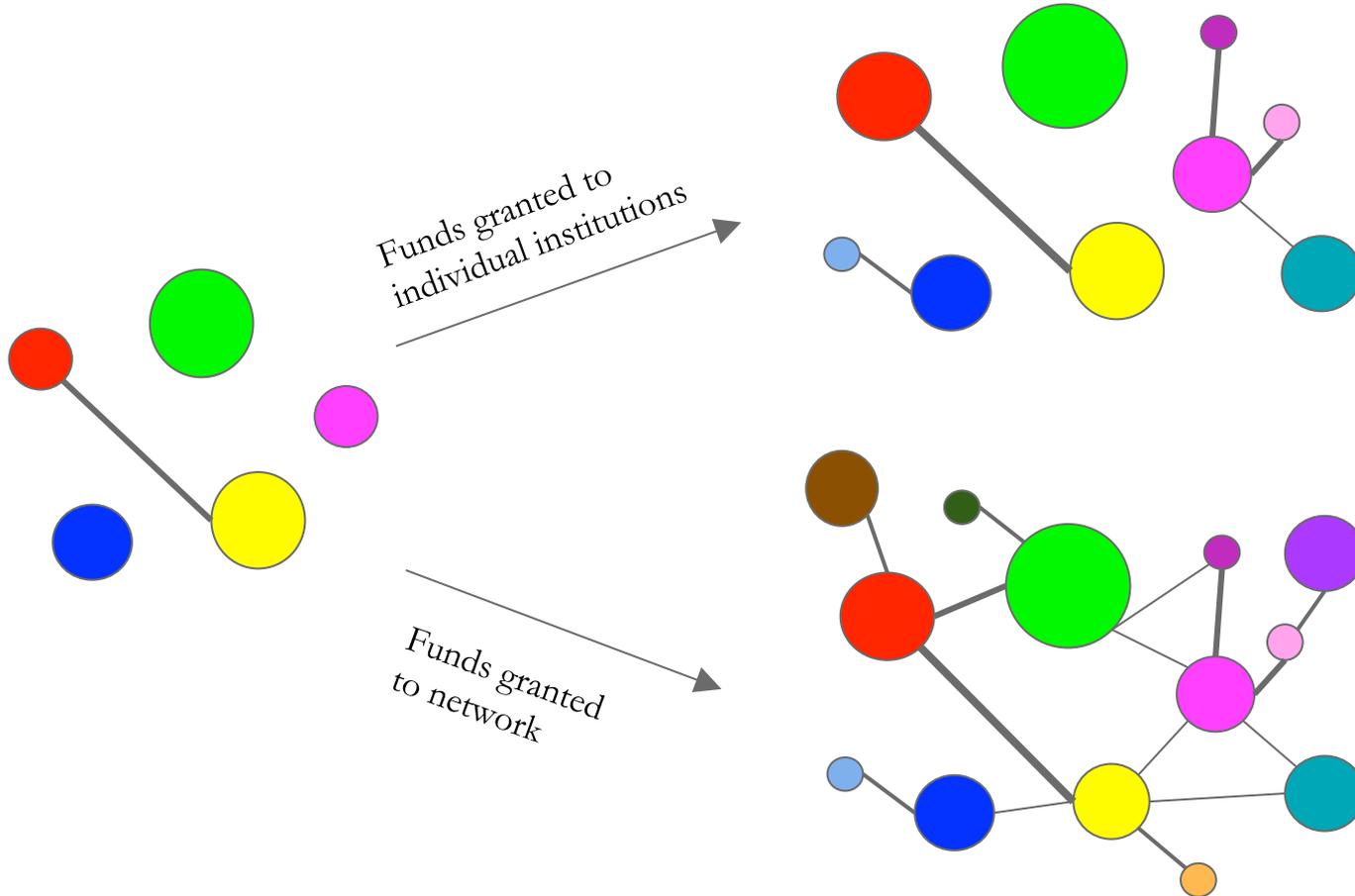
- Census of CompSustNet Participants: This questionnaire is to collect basic data on participants, broadly construed, of CompSustNet.
- Feedback on OEDS at CompSust-16: We welcome feedback on issues related to Outreach, Education, Diversity, and Synthesis (OEDS) for CompSustNet..

A funded network should be “*a whole that is greater than the sum of its parts*” (NSF)



What does that mean operationally? How do we measure the magnitude of the difference?
How do we report the difference? How do we track the difference?
What is the threshold of success?

Greater than the sum of parts as greater “gravitational” attraction (that manifests over time)



More nodes, and/or
More edges, and/or
Larger nodes, and/or
Heavier edges, and/or
...

CompSustNet: Expanding the Horizons of Computational Sustainability: what do we want to achieve and therefore, what do we want to quantify and qualify

Expand the breadth

- Of participating institutions, academic and corporate

- Of knowledgeable and contributing faculty, researchers and/or educators

- Of professionals

- Of students, undergraduate and graduate

- Of government officials at all levels

- Of citizens

- Of (active) research and educational areas of study (e.g., cradle to cradle design)

Expand the depth (density)

- Of collaborations

- Of academic offsprings

Publications, citations, and other legacy (e.g., programs, practices, policies)

Diversity

Goals:

- Grow CompSustNet in numbers, depth, and breadth, characterizing diversity of gender, race and ethnicity, geography of institutions, research and educational areas, and other dimensions
- Explore the incentivizing power of CompSust for entry and retention in computer science (CompSust has been proposed as increasing gender diversity in particular)

Projects and Activities:

- Please fill out the computational sustainability census at <http://blog.computational-sustainability.org>
- Followup (and infrequent) surveys may request anonymized feedback on race and ethnicity, gender, and other dimensions following best practices (e.g., as found in *Women, Minorities, and Persons with Disabilities in S&E* <http://www.nsf.gov/statistics/women/>; *Racial and Ethnic Diversity among U.S.-Educated Science, Engineering, and Health Doctorate Recipients: Methods of Reporting Diversity* <http://www.nsf.gov/statistics/infbrief/nsf12304/>)
- Interviews and testimonials on incentives from computational sustainability, as well as professional trajectories
- Interactive tool that illustrates CompSust professional trajectories (as part of larger project)

Synthesis

Synthesis can result in composition

Projects:

- Sustainability-focused cognitive agents
- Project/paper recommender systems
- Story telling AIs on end-to-end processes
- AIs that assist in environmental impact reports

Data Acquisition

Data Interpretation

Data Integration

Model Fitting

Policy Optimization

Policy Execution

Goals:

- To be conversant on the CompSustNet projects
- To understand, explore, and expand the connections between these projects, and others
- To make the projects accessible to a broader public, to include other scientists

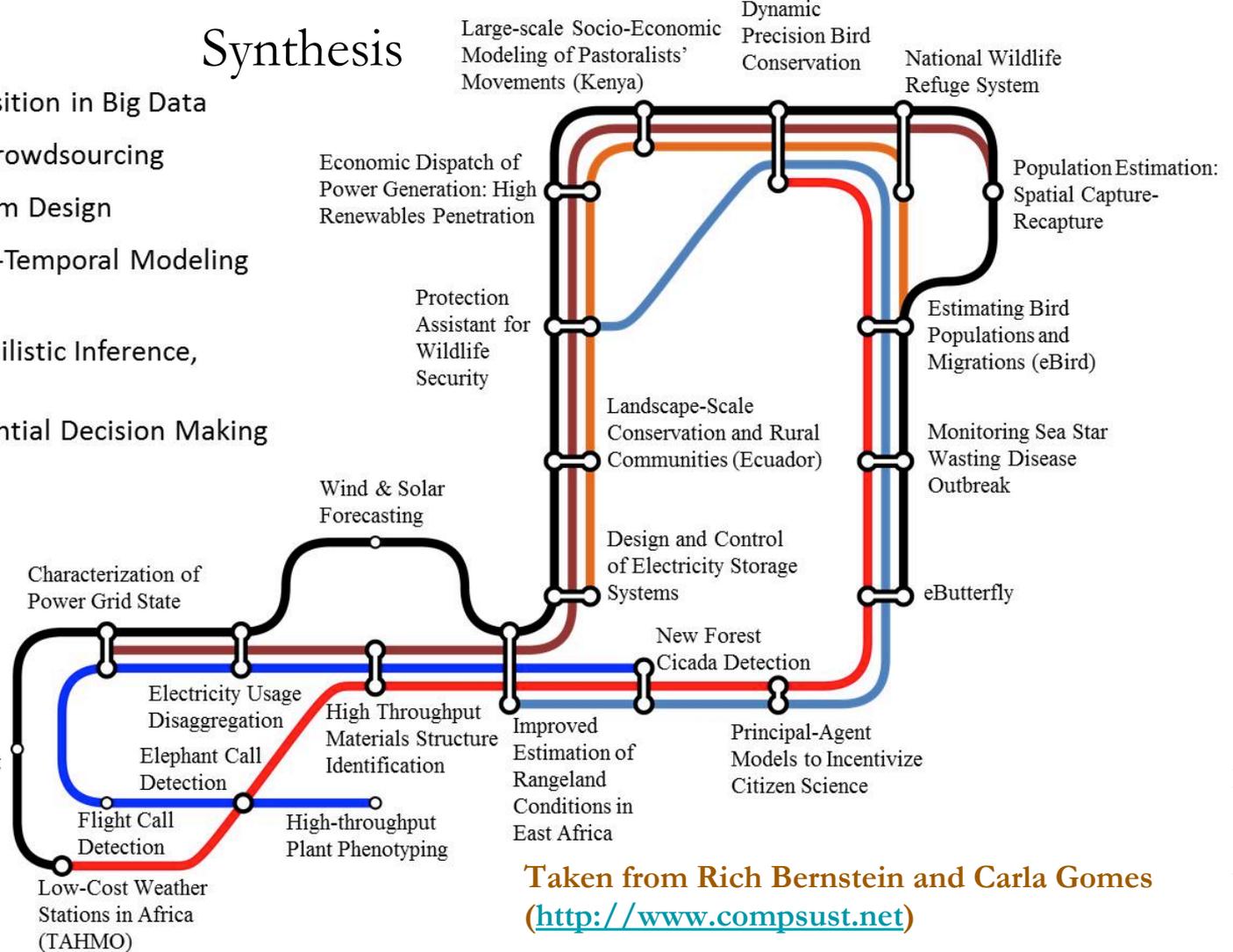
Adapted from Tom Dieterich presentation at *AI for Social Good*
<http://cra.org/cac/artificial-intelligence-social-good-speakers/>

Synthesis

- Pattern Decomposition in Big Data
- Citizen Science/ Crowdsourcing
- Agents: Mechanism Design
- Large Scale Spatio-Temporal Modeling and Prediction
- Stochastic, Probabilistic Inference, and Optimization
- Large Scale Sequential Decision Making

Synthesis can result in abstraction

Projects: interactive maps & other visualizations



Taken from Rich Bernstein and Carla Gomes
(<http://www.compsust.net>)

Outreach (to facilitate informal learning)

Goals:

- Design, implement, and assess informal educational activities, materials, and programs,
- particularly those that are adopted beyond CompSustNet institutions during the period of funding

Sample Projects and Activities

Science fairs, educational video and board games, camps, and other activities sponsored by individual institutions, but as appropriate

- work with institutional units (e.g., Vanderbilt's Center for Science Outreach at <http://vanderbilt.edu/cso/>) to
- create variants that are persistent and generative

Magazines such as *AI Magazine* (e.g., the special issue on Computational Sustainability) and *IEEE Intelligent Systems* (e.g., see the review of AAAI-16 CompSust papers at

<http://blog.computational-sustainability.org/2016/06/09/summary-of-computational-sustainability-papers-at-aaai-2016/>)

Outreach (to facilitate informal learning) and FORMAL learning too

Sample Projects continued

Online Courses and modules on computational sustainability



co-created by nodes, with nodes in Australia, South America, Asia, and Africa too

Outreach (to facilitate research dissemination)

Goals: To circulate research within the network, and to & from outside CompSustNet as well

Sample Projects and Activities

- Interacting with Other Centers (e.g., *National Socio-Environmental Synthesis Center*; *Transdisciplinary Research Network for Sustainable Climate Risk Management*; *Center for Sustainable Materials Chemistry*)
- Online seminar series (with speakers from across CompSustNet)
- CompSustNet Conference(s), of which *CompSust-2016* belongs
- Existing conferences (immersion) – tracks, tutorials, awards – e.g., *AAAI*, *IJCAI*,
- Letters of support for research proposals, on data access, broader impact plans, open problem sets?
 - A CompSustNet data repository?
 - A CompSustNet Open Problems (a survey suggestion)

Outreach (Social Media)

- Web page (Rich Bernstein manages) at <http://www.compsust.net>.
- News feed from Web page (Rich Bernstein manages)
- University news and public affairs offices (with investigators as intermediaries)
- NSF and other agencies' news offices
- [CompSustNet blog](http://www.vanderbilt.edu/cst/) (for original news stories, such as *AI for Social Good* presentations, with vetted writers, perhaps undergraduates from programs like Vanderbilt's *Communication of Science and Technology* major at <http://www.vanderbilt.edu/cst/>) Zimei and Selina have already started.
- @CompSust Twitter (Mark Crowley and Doug Fisher co-manage)
- Facebook CompSustNet page (Christianne McMillan manages)
- Mailing list at comp-sustainability@yahoogroups.com
- **CompSustNet Quarterly Newsletter?**

Education (to facilitate formal learning)

Goals: to infuse computational sustainability into the fabric of higher education, and K-12

Sample Projects and Activities

- **Campus Courses on computational sustainability** (see <http://blog.computational-sustainability.org/2016/04/11/university-courses-in-computational-sustainability/> and <https://my.vanderbilt.edu/csx892/files/2016/06/IncorporatingSustainabilityintoComputingEducationPreprint.pdf>)
- **REU (supplements and sites):**
<http://blog.computational-sustainability.org/2016/06/04/welcome-undergraduates-to-compsustnet/>
- **Online Course (and hybrid course):**
<http://blog.computational-sustainability.org/2016/06/28/a-global-online-course-in-computational-sustainability/>
- **AI for Computational Sustainability wikibook** (Fisher, Dilkina, Eaton, and Gomes, 2012) and other online repositories
- **Computing Education conferences** (e.g., SIGCSE) and journals
- **Professional development education for a future in computational sustainability**



https://en.wikibooks.org/wiki/Artificial_Intelligence_for_Computational_Sustainability:_A_Lab_Companion

Preamble

[edit]

This laboratory companion is designed to introduce students of artificial intelligence (AI) to problems of environmental and societal sustainability, together with projects and problem sets at the intersection of AI and sustainability. The lab text can accompany any primary AI



Search this book

Sample Lab Assignment: Species Distribution Modeling Using Maxent*

Lab Summary:

1. Students examine the effect of climate and climate change on the distribution of several species of tree
2. Using species-range data, students model species distributions using maximum entropy (Maxent)

AI Concepts:

distribution modeling, Maxent, ROC analysis

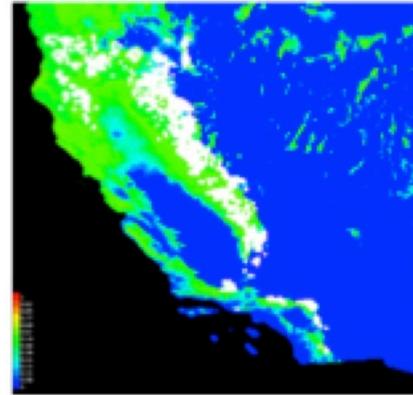
Sustainability Concepts:

species distribution modeling, climate change

Cross-referenced in *Machine Learning for Prediction and Biodiversity*



Zimei Bian and Selina Chen are working on assignments that exercise search and optimization for wildlife corridor and reserve design.



The wikibook also lists *Additional Resources*, to include readings from computational sustainability courses to date.

Other lab companions may follow.

* This lab is based on an assignment by Park Williams (UCSB Geography), and was extended for an AI audience and posted to the Wikibook with his permission. Contributed by Eric Eaton.