How I (try to) talk about science and engineering with the hopes of not making peoples eyes glaze over

Daniel Tkacik

Previous: Ph.D., Civil & Environmental Engineering, CMU
Postdoc, Mechanical Engineering, CMU

Now: Communications Manager, CMU’s College of Engineering

postdoctoral researcher studying climate change at Australian National University

Dr Georgy Falster @raindrop_herder · Feb 7

all plain language summaries should aspire to the glorious heights of this piece of literary art

JAMES | Journal of Advances in Modeling Earth Systems

RESEARCH ARTICLE
10.1029/2020MS002301

Key Points:

- Machine learning is successfully applied to the warm-rain parameterization problem
- Training and testing data for the warm-rain kinetic collection equation are provided using the superdroplet method
- Standard training methods show some limitations for the resulting ODE system

Supporting Information:

- Supporting Information S1

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Potential and Limitations of Machine Learning for Modeling Warm-Rain Cloud Microphysical Processes

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Abstract The use of machine learning based on neural networks for cloud microphysical parameterizations is investigated. As an example, we use the warm-rain formation by collision-coalescence, that is, the parameterization of autoconversion, accretion, and self-collection of droplets in a two-moment framework. Benchmark solutions of the kinetic collection equations are performed using a Monte Carlo superdroplet algorithm. The superdroplet method provides reliable but noisy estimates of the warm-rain process rates. For each process rate, a neural network is trained using standard machine learning techniques. The resulting models make skillful predictions for the process rates when compared to the testing data. However, when solving the ordinary differential equations, the solutions are not as good as those of an established warm-rain parameterization. This deficiency can be seen as a limitation of the machine learning methods that are applied, but at the same time, it points toward a fundamental ill-posedness of the commonly used two-moment warm-rain schemes. More advanced machine learning methods that include a notion of time derivatives, therefore, have the potential to overcome these problems.

Plain Language Summary In our work, we are trying to teach a computer how rain forms in clouds. We show that computer hundreds of cases in the form of data. To be honest, the data are not real data but only results of simulations with a more complicated computer model. This complicated model can track the collisions of 10,000 of droplets, and we save all that data about the growth of the droplets into larger raindrops. This is what we then give to the simpler computer model to teach it something about clouds and rain. Afterward, it can make pretty good predictions about which clouds will rain and how long it will take them to produce the first rain. Unfortunately, the current machine learning methods are still a bit stupid because they only learn from the data but do not understand the mathematics and the physics behind the data. Therefore, the new computer model is still not as good at predicting rain as some clever mathematical formulas that were developed 20 years ago. Maybe we first have to teach the computer model more about calculus before it can learn to predict rain.

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Questions I ask myself when I sit down to write a story about complicated science

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Why should my audience care about this?

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What would the funding agency say this work's "societal impacts" are?

Someone thought it was a good idea to put money towards this project. Why?

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Maybe cliche, but it’s used a lot for good reason:

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Maybe cliche, but it's used a lot for good reason:

How would you explain this to an 8 year old?

Exploration of laser degating and welding of plastics for commercial opportunities

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My initial guess at what's going on here:

Messing around with these two methods for making plastics

(why? what's the goal? "commercial opportunities" doesn't tell me much, yet)

Exploration of laser degating and welding of plastics for commercial opportunities

This project will enhance a partnership between Robert Morris University (RMU) and MECCO (an integrator of laser marking systems) to provide the resources to jointly demonstrate the utility of lasers for plastic degating and welding to serve the needs of the plastics manufacturing industry. RMU and MECCO have been working together for three years researching plastic welding. MECCO has proven they can build viable systems with over 20 commercial laser welding systems delivered to just one international customer. RMU has proven they can test, analyze and optimize weld parameters with the resources in their Learning Factory. With previous support from DCED, RMU and MECCO were able to design and build a portable welding system, design a universal test piece, expand on the number of plastics successfully welded, and begin to explore welding 3D printed components. This effort involved 3 faculty and 11 students, and contributed to 2 masters theses and 3 honors theses and one student has transitioned to a full time position at MECCO and another is in consideration. The progress from this collaboration is leading to the commercial launch of a line of laser welding systems by MECCO in 2021. Through this work and conversations with customers, other opportunities for innovation were identified such as additional welding applications and utilizing lasers to degate injection molded plastic parts. MECCO will loan a CO2 laser to RMU for the degating investigation and provide other in-kind support with access to their knowledge, experience, and applications lab. With the support of the Manufacturing PA Innovation Program, RMU and MECCO will be able to involve more students in this effort and expand their ability to conduct welding and degating experiments and explore potential customers and markets for this technology

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What will this new line of laser welding systems be able to do that wasn't previously possible?

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What are the specific needs of the plastics industry? What are some plastics that consumers are familiar with that this affects?

What will this new line of laser welding systems be able to do that wasn't previously possible?

How will this work someday affect the plastics that everyday consumers interact with?

Skeleton of summary

- **What is the problem or issue that this project addresses?**
- **Why does it matter to non-researchers?**
- **How might this project affect non-researchers' lives?**
  - [Stronger, easier to make, etc.] plastics will lead to [thing that affects non-researchers]

Does anyone want to take a stab at giving a plain language summary of their project in 60-90 seconds?