EARTH DAY 2020 50TH ANNIVERSARY

AI AND THE ENVIRONMENT
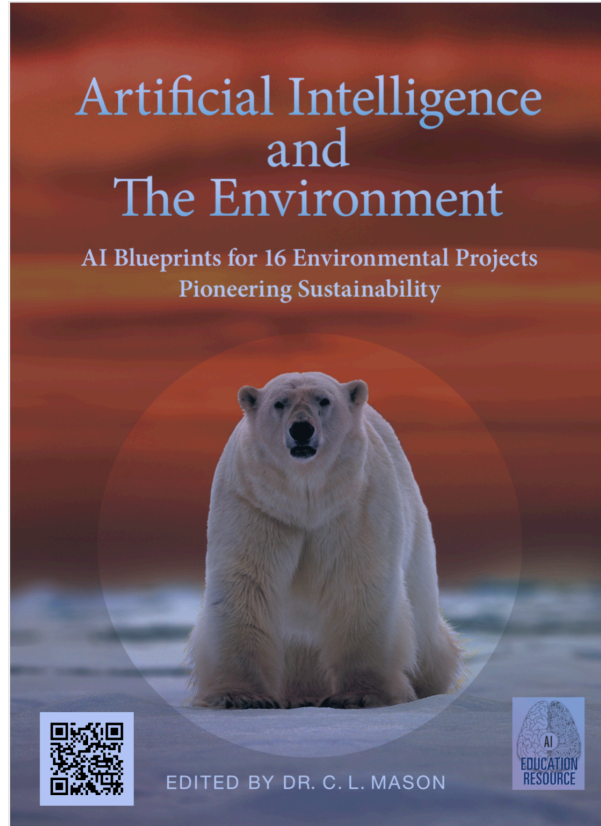
A DIGITAL EDUCATION EVENT
April 19-22, 2020
#AIforEarthDay

Post-Event Summary
Official registered EarthDay Education Event

Digital EarthDay 2020 AI Educational Event Summary

Title: Sharing insights on using AI for Environmental Problems from 16 Projects

#AIforEarthDay

For Earth Day this year, much of the activities were online due to Corona Pandemic. We hosted an AI education event April 19-22 on Twitter and Facebook. These are the collected Tweets and Posts from those 4 days. The event was registered with earthday.org through MIT. The materials in the tweets/posts are based on a lecture given at the AI Center at SRI Intl. Menlo Park, California, USA. It is drawn from the first textbook on AI and the Environment where 60 scientists shared their ideas for 16 environmental projects. The Tweets are summarized here for those who were not able to attend/not on Twitter.

For more information see www.aiandenvironment.org

TWEET Summary**

AI and Environment
@ai_environment

Hashtag: #AIforEarthDay
Twitter Account @ai_environment

Tweet Total: 75

Day 1	Day 2	Day 3	Day 4
11	28	19	17

Distribution: Originally tweeted from the US with shadow tweets from Spain. During the event we were retweeted and picked up in India, Norway and Germany. The retweeting locations from those accounts are unknown.

Readership: 32 Followers, most were science, technical, educators or communicators. Shadow accounts: unknown.

Format: We began adding time stamps midway through as the net was slowing with traffic and tweets were posted out of order.

Day 0   Sat April 18

#AIforEarthDay Event Announcement:
We are now registered on the http://EarthDay.org event!   For the 4 days up to April 22, we will be tweeting an education event, with insight across the use of AI for 16 different environmental projects.

Day 1   Sun April 19
Tweet 0
Environmental projects have unique patterns of data and systems and the AI systems to address them can be as complicated and interdependent as GAIA herself.   For example, the data is not just big. Its Big, Hairy and Lumpy (BHL). #AIforEarthDay

Tweet 1
Why is the data for Environmental Projects Big, Hairy and Lumpy(BHL)? The answer is in 2 parts.   The first part of the answer, part 1, is there is a variety of time scales and a long history of data collection. Relevant data (when history is useful) can occur at different time scales.

Tweet 2
Why is the data for Environmental Projects BHL? Second, part 2, The media is complex! Many different kinds of information are relevant to a single problem - Landsat, vegetation maps, satellite mapping, output files from simulations, modeling, dsp, sensors, cams, human logs, etc.

Tweet 3
How can AI help with these 2 Big Hair Lumpy data issues?   First, AI has temporal scale abstraction/transformation methods useful for integrating and sharing information across time, zooming in and out of scales of time and space during problem solving.#AIforEarthDay

Tweet 4
Cont'd: How can AI help with these 2 BHL issues? Second, AI uses ontology methods to create a language of meaning across different data and meaning can be shared, communicated/explained for people and machines and used for transforming info with time/scale issues. #AIforEarthDay

Tweet 5
Another characteristic of environmental projects is Complexity. Complexity of systems and data occurs in a very human context. Many projects require tight knit relationships between people and AI systems, especially in scenarios with environmental emergencies. #AIforEarthDay

Tweet 6
Complexity Issue 1) Environmental problems are often global problems involving global communities with implications and constraints from different cultures and social norms. #AIforEarthDay

Tweet 7
Complexity issue 2) These AI Systems require an explanation facility. It is not an option.   Because these systems are naturally people centered technology.   This means the system needs methods not just to solve problems but languages, interfaces, ontologies, etc. #AIforEarthDay

Tweet 8
Complexity issue 3) User interfaces often play a key role not just because of the need for an explanation facility but because decision making and prediction systems are also big and hairy data and systems. cont'd #AIforEarthDay

Tweet 9
cont'd Complexity issue 3: decision making and prediction systems need - Flexible points of view - Zooming in and out, combining and viewing different scales of time and space- Ability to explore many possible predictive scenarios (cpu and data intensive). #AIforEarthDay

Tweet 10
cont'd-2 Complexity Issue 3) Finally, decision makers (people) need to use Prediction Systems with lots of different modeling and simulation systems that require 'on the fly' model / parameter changes.   How can AI handle this complexity?? #AIforEarthDay

Tweet 11
Complexity- How Can AI Help? In predicting plant physiology under climate change an AI system helps the user examine more scenarios in a shorter time period. It automatically generates a prediction system using only the relevant models, knowledge for each query.   #AIforEarthDay

Day 2. Mon April 20

Tweet 1
Hi, Welcome to Day 2 of the #AIforEarthday Event!   Yesterday we began talking about the computational challenges and patterns unique to environmental domains… Big Hairy Lumpy Data,close human-machine collaboration, Complexity.

Tweet 2
#AIforEarthDay. Today we continue the conversation about unique computational challenges of environmental domains: Complexity, the dynamic phenomena of natural systems and "The Global Multi Scale (GMS) Problem". You will discover how Hybrid AI is the key architecture.

Tweet 3
#AIforEarthDay We will also look at these computational patterns in two domains: fire fighting and forestry sustainability. First, I will fill you in on some background with 3 questions. 1. Who are these scientists? 2. What environmental domains? And 3. Why do we need AI/ML?

Tweet 4
#AIforEarthDay 1. Who are these scientists? The systems and patterns I'm discussing come from the work of 60 pioneering AI researchers from a competitive international AI community known as IJCAI. They originate from New Zealand, Germany, Canada, US, Italy and other countries.

Tweet 5
#AIforEarthDay 2. What environmental domains? Our discussions here come from 16 different environmental domains. I've divided them into two types. The first, "Boots on the Ground," involves getting dirty. The second is, "Data, Data, Everywhere." I list them in the next tweets

Tweet 6
#AIforEarthDay 2 cont'd. What environmental domains?   "Boots on the Ground" domains are fire fighting, flood prediction, sewage and pollution, sustainable forests, water pollution, toxic algae blooms, recycling and resources, arguments and decisions and monitoring nuclear tests.

Tweet 7
#AIforEarthDay 2 cont'd. What environmental domains? "Data, Data, Everywhere" domains are Assembling Satellite Data, Forest Ecosystem Modeling, Weather Bulletins, Weather Forecasting, Sharing Digital Resources, Biodiversity Cataloging, Plant Physiology and Climate Change.

Tweet 8
#AIforEarthDay 3. Why do we need AI/ML?
Each one of the domains is extremely important and diving deeply into them here is very tempting.   But what's important is to look at the unique computational qualities of these domains. We see that these qualities are AI's raison d'être.

Tweet 9
#AIforEarthDay 3 cont'd.   Why do we need AI/ML? The patterns also tell us strategically how we need to budget, what skills and computational resources we need and they show how important continuity of teams and resources are for success.

Tweet 10
#AIforEarthDay 3 cont'd.   Why do we need AI/ML?
Environmental problems are often ill defined with incomplete, uncertain and sometimes totally absent information. AI has many tools for making decisions w/ incomplete, uncertain and unknown data.

Tweet 11
#AIforEarthDay 3 cont'd Consider for example, sewage and water treatment. It affects water supplies, industry, environment..making decisions during flood conditions, whether to close/open a valve, or to reduce/increase flow, has implications for evacuation, transport, health,etc

Tweet 12
#AIforEarthDay Numerical methods require precision, but the precise size and shape of a body of water (e.g. perimeter of lake, flow rates, etc.), is rarely known. Distributed sensor intelligence, fuzzy and qualitative modelling, common sense are but a few of AI's helpful tricks.

Tweet 13
#AIforEarthDay 3 cont'd Why we need AI/ML?   The data is not just enormous but complex - combinations of time-series, satellite, flood and water instrumentation, human logs, etc. They vary in scales of time and space from small collection of regions to an entire planet.

Tweet 14
#AIforEarthDay 3 cont'd Why we need AI/ML? There is also a need to integrate information and the meaning of that information across different kinds of media from hydro, spatial, topo and Landsat maps to images of species and handwritten notes.

Tweet 15
#AIforEarthDay 7.53pm. Why we need AI/ML? Machine learning and (deep)neural nets help us recognize patterns from our sensor data and networks. Many AI technologies also help people to consider decisions in the face of uncertainty and incomplete information.

Tweet 16
#AIforEarthDay 7.56pm. Why we need AI/ML cont'd. Common sense AI methods help explain and share the meaning of data and decisions in a way that is accessible to people and helps when faced with incomplete information. Ontologies are a common language for sharing data's meaning.

Tweet 17
#AIforEarthDay 8.08pmThat completes the answers to the 3 questions! We have now answered What is the science, Who are the scientists, Why we need AI/ML?   Next let's return to the computational / data patterns of environmental projects and issue of complexity.

Tweet 18
#AIforEarthDay 8.10pm Another aspect of complexity is that Nature is Dynamic. The environmental projects we develop our AI system for involve dynamic processes - fire, flood, weather, pollution, toxic algae bloom….   change (unpredictably) over time…

Tweet 19
#AIforEarthDay 8.12 Whatever kind of tool you are building, whether its for decision making, predictions, aggregators, simulators, modelling, etc. and whatever AI technology you engage…software agents, Intelligent User Interface, ML, NN, etc. is affected by this…

Tweet 21
#AIforEarthDay 11.27pm
The Global Multi-Scale Problem (GMS) of environmental projects are a consequence of the fact environmental problems and emergencies often occur across large regions of the earth. This has practical implications for the data both in research and in emergencies.

Tweet 22
#AIforEarthDay. 11.35pm
The GMS aspect of environmental projects and emergencies often take place across multiple agencies, geographic territories, government. departments - national, local, city, county, dept, etc.

Tweet 23
#AIforEarthDay. 11.35pm Environmental projects and emergencies is that they often take place across multiple agencies, geographic territories, government. departments - national, local, city, county, dept, etc. Not only does it affect the data, it also affects people.

Tweet 24
#AIforEarthDay 11.40pm. Each agency, territory, department, government and so on has its own policy on communication, data sharing, protocols, procedures, resources, coordination, workflows, etc. It requires Intricate levels of cooperation and trust, with people and machines.

Tweet 25
#AIforEarthDay. 11.44pm
The GMS problem also has an impact on formats and forms of data and information.   For example, in forestry sustainability, large areas of the earth coverage are involved in decision making about timber harvesting and planting.

Tweet 26
#AIforEarthDay. 11.47pm Forestry sustainability data comes in FAST and is collected for decades. It includes topographic, hydrology, and geology maps, soils data, remote sensing, ... Agencies have differing access policies and multiple formats for each type of data.

Tweet 27
#AIforEarthDay 11.54pm Today we covered the What, Who and Why of AI and Environment's insights and completed the patterns of complexity and Global Multi-Scale Problems that occur across environmental projects. That's a wrap for the tweets on April 20! See You Tomorrow!

Tweet 28
#AIforEarthDay 12.04am
Its now earthday!!!!   But a day? We need Earth Year!
#EarthYear

Day 3. Tues April 21

Tweet 1
#AIforEarthDay 10.10pm Yesterday we shared the complexity and global multi scaling issues that are common among environmental issues. We answered 3 questions - Who the Scientist are, What is the Science, and Why is AI/ML important/helpful.

Tweet 2
#AIforEarthDay.10.07pm. Its Day 3 of the registered Earth Day http://EarthDay.org event!   For the 4 days up to April 21, we will be tweeting an education event, with insight across the use of AI for 16 different environmental projects.
#ActOnClimate #sustainability

Tweet 3
#AIforEarthDay 10.16. Environmental projects have unique patterns of data and systems and the AI systems to address them can be as complicated and interdependent as GAIA herself.   Complexity, Global Multi-Scaling and Big, Hairy and Lumpy (BHL) data. #AIforEarthDay

Tweet 4
#AIforEarthDay 10.21pm To cope with these very real and daunting challenges AI programmers and scientists take an approach called Hybrid AI - when just one kind of AI is not enough. In Hybrid AI many kinds of systems and subsystems work together. #ai #ClimateEducation

Tweet 5
#AIforEarthDay 10.26pm Hybrid AI involves multiple AI/ML/NN/robotics/drones/etc. subsystems with intelligent user interfaces, as well as 'standard' or non-AI computing, modelling, simulation, image analysis, geographical information systems (GIS), sensor networks, DSP, etc. #

Tweet 6
#AIforEarthDay 10.34 Let's take a look at the domain of firefighting. Its a dynamic phenomena-fire evolves with weather, wind intensity and direction, precipitation and humidity.The fuel type changes as fire evolves, moves - trees, buildings, industry, toxins, vegetation. #ai

Tweet 7
#AIforEarthDay 10.38 Fire fighting domain cont'd. Another element of the dynamic nature of fire is its speed also changes. In fact, all parameters of a fire change rapidly sometimes unpredictably. #AI #ClimateAction

Tweet 8
#AIforEarthDay 10.42 People are a big part of solving our environmental problems. AI systems design respects close human-environment relationships, with people as part of the decision making, input and interfaces. Fire fighting is a good example of this. #AI

Tweet 9
#AIforEarthDay 10.50pm Today's state of the art fire fighting user support includes mobile units carrying command centers for decision support that interact with vehicles gathering info and taking action at many elevations and locations... #ai #ClimateEducation

Tweet 10
#AIforEarthDay 10.56 Fire fighting domain description cont'd. Fire fighting has many traits that we talked about - GMS, BHD, Complexity, and Human-Machine Collaborations. We will look at the fire fighting domain and describe a AI system created for a region in Italy.

Tweet 11
#AIforEarthDay 11.02pm Firefighting domain: AI system operation supports human assessment, decision making, operations and planning activities. There is a dynamic nature to these operations because of the dynamic nature of fire situations: time - people need to think fast. #ai

Tweet 12
11.03pm Firefighting domain: Fire emergencies often cross wide areas of terrain so there are multiple operation and decision making centers (GMS). This requires coordination and cooperation across centers (GMS).   What about the data? It is Big Hairy and Lumpy.

Tweet 13
#AIforEarthDay 11.07pm Firefighting domain: Relevant historical cases and their data are helpful, but they can have different qualities. Time and spatial scales differ - seconds-days,meter-kilometer. Fire data is always incomplete, uncertain, and sometimes totally absent.

Tweet 14
#AIforEarth 11.15pm Firefighting domain. We now look at an AI system developed to help with firefighting in Italy. The system is built by Paolo Avesani, Francesco Ricci and Anna Perini, I.R.S.T.(Instituto Scientifico Romagnolo per lo Studio e Tecnologico) #AI #ClimateEducation

Tweet 15
#AIforEarthDay 11.21pm Fire Fighting Domain:The system focuses on decision support in the planning strategy for the first attack(which resources, where, priority, etc.)First attack is key determiner in many cases.System design focuses on fire fighting in Italian Provencial center

Tweet 16
#AIforEarthDay 11.24pm Italian Fire Fighting AI System: The Big, Hair Lumpy Data:1) Infrared and meteo satellite, remote sensed 2)Previous plans* 3) Geographical information,simulation data 4) Input from other centers, locations, organizations. *different time and spatial scales

Tweet 17
#AIforEarthDay 11.29 pm Italian Fire Fighting AI System:Approach: Hybrid AI - combine graphical simulation of fire evolution, resource management tools, and sensor data processing together with AI systems. #ai #FutureTech #greentech #sustainability #education #EarthDay

Tweet 18
#AIforEarthDay 11.34 pm Italian Fire Fighting AI System: Although the fire fighting domain has lots of Intelligent User Interface issues and systems, including multiple software agents, the system description is only covering the AI/ML aspects for supporting first decisions. #AI

Tweet 19
#AIforEarthDay 12.02pm That's it for day 3 of our EarthDay AI Education Event! Thank you for caring about these difficult issues.These tweets will be collected and posted in various places including here. And now, because it is #EarthDay

 I will go outside and look up. Happy EarthDay!

Day 4. Weds April 22. EARTH DAY
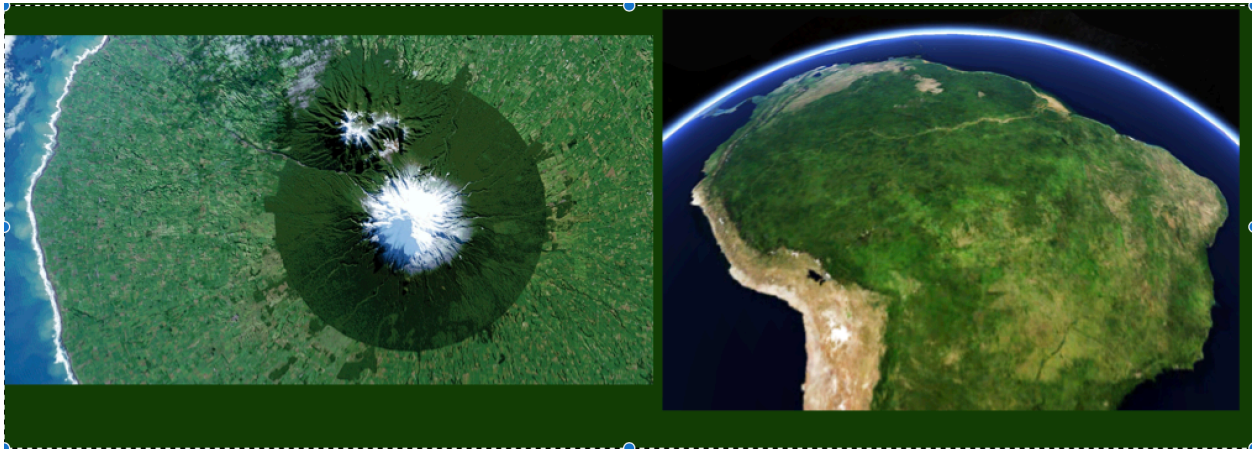
Tweet 1
#AIforEarthDay 9.18pm Happy Earth Day!
Its our last day of the registered Earth Day http://EarthDay.org event!   For the past 3 days we were tweeting about insights from 16 different environmental projects that use AI. The science and the data can be as complicated and interdependent as GAIA herself. G-AI-A. :)

Tweet 2
#AIforEarthDay 9.32pm Yesterday we talked about Hybrid AI, where one kind of AI is not enough. We also explored fire fighting, a dynamic phenomena with complexity, human-machine collaboration, global-multi-scaling, and Big Hairy Lumpy data. #AI #Tech #greentech

Tweet 3
#AIforEarthDay 9.48pm We also explored an AI system from Italy that supports fire fighting planning and decision making for the first attack, a key determining moment in fire fighting that determines which resources, priorities, where, etc. Today we look at sustainable forests.

Tweet 4
#AIforEarthDay 9.55pm Sustainable Forest Domain: Data repositories built to monitor/observe/study biosphere and trends in vegetation for a very long time. Forests are the largest vegetative component on surface of the Earth

Tweet 5
#AIforEarthDay 9.55pm Sustainable Forest Domain: #AIforEarthDay 9.58pm
Sustainable Forest Domain: Connifer forests provide 73% of world's industrial
logs.   People make decisions and plans about harvest or not, planting or not,
based on the knowing the current state of living things locally, regionally,
globally. #ai #greentech

Tweet 6 (it was actually 10.15 when it finally went out)
#AIforEarthDay 10:12pm Sustainable Forest Domain: First, the domain is
dynamic, like most environmental projects or domains, forests vary with
-terrain -steep, hilly, mountain, plains,..
-climate - tropical, subtropical, desert..
-condition-new, established, insects, burns..

Tweet 7
#AIforEarthDay 10:25 pm Sustainable Forest Domain: Decision making and planning involves many scientists and image analysis systems, including Forestry ecosystem modelling and simulation, Topo Maps, Remote Sensing Analysis, DB Design, Visual Information Design, GIS operations.#ai
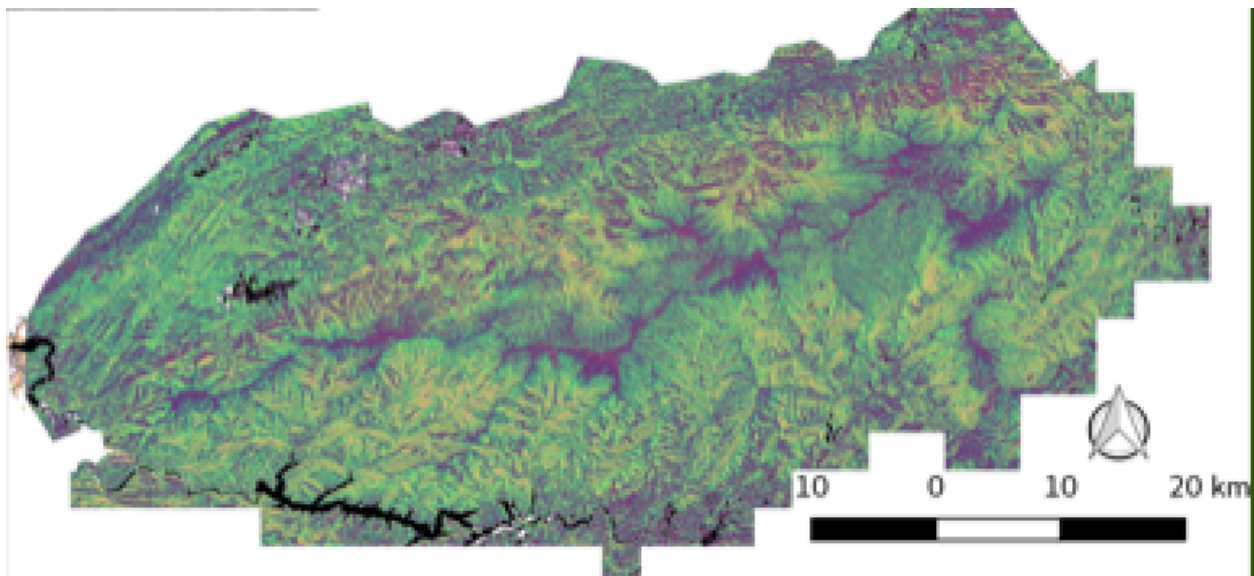
Tweet 8
#AIforEarthDay 10:30 pm Sustainable Forest Domain: Here's how complexity and BHL shows up in this domain.. First, Access, use and analysis of forestry data is problematic due to different policies, codes of forestry practices across the terrain.

Tweet 9
#AIforEarthDay 10:35 pm Sustainable Forest Domain:
Second, Data integration, composition and sharing is challenging because it varies in Granularity, with different Formats and Media types that have changed over time as well.   Remember data collection happens over decades.#ai

Tweet 10
#AIforEarthDay 10:30 pm Sustainable Forest Domain:
Because there are many organizations, institutions, governments and so on that collaborate, there are also many different computing environments where data resides and the software tools to extract information are widely variable.

Tweet 11
#AIforEarthDay 10:48pm Sustainable Forest Domain: The Swedish/Canadian system uses a Hybrid AI approach. First they use ML to Auto-Create agents. They built a Training Interface System for each of the software systems that learns by example from scientists. #greentech #ai

Tweet 12
#AIforEarthDay 10:54 pm Sustainable Forest Domain: As scientists engage GIS/image analysis tools, sw agents in background mode grow in sophistication as they watch the interaction and learn Sequence, Task Circumstances. #ai #greentech #earthday

Tweet 13
#AIforEarthDay 10:58 pm Sustainable Forest Domain:
The intelligent user interface techniques generate the SW agents that work to feed information to other AI systems including a Derivational Analyzer, a Case Based Reasoner (decisions in the past can be helpful) and a Planner.

Tweet 14
#AIforEarthDay 11:08 pm Sustainable Forest Domain:
The intelligent user interface approach is expandable because it creates as many software agents as needed, allowing design to flow from the scientists way of interacting and using the systems and sharing data. #ai #greentech

Tweet 15
#AIforEarthDay 11:15pm Summing UP: For the past few days we have shared insights on using AI from 16 different environmental projects.These domains have dynamic phenomena with complexity, human-machine collaboration, global-multi-scaling, and Big Hairy Lumpy data. #ai #EarthDay

Tweet 16
#AIforEarthDay 11:24pm Summing Up: We looked at the essential character of two environmental domains- fire fighting and sustainable forestry. Then we explored the Hybrid AI architecture for these domains. For more detail on these and other domains see http://aiandenvironment.org

Tweet 17
#AIforEarthDay 11:30pm Earthday AI Education Event Final Tweet: It has been a labour of love.   Thank you.   Thank you everyone for caring and working so hard.   Earthday April 22, 2020. "So long, and thanks for all the fish" Douglas Adams

End of Summary

**in order to coordinate with Spain, who were helping tweet, and at times I would think of the time in Spain, which was already the next morning, so occasionally my original tweets had time errors! These have been corrected here in the report for consistency. It just shows how even small things like cooperating across several time zones can be challenging!

Uploaded April 23, 2020
THIS IS A PRELIMINARY DRAFT
Questions?
Contact: cmason@cmason.us