DRIVENDATA

I. Individual information for winner announcement

Please provide your preferred information for use in announcing the winners of the competition. If you are on a team, please copy this section as needed and complete it for each team member.

Team member 1

- Name (first and last name or first name and last initial): Sebastian Sanchez Bernal
- Hometown: Mexico City, Mexico
- A recent picture of yourself or digital avatar (feel free to attach separately):
- Social handle or URL (optional): https://www.linkedin.com/in/sebastiansanchez6/
- Who you are (mini-bio) and what you do professionally:

Sebastian Sanchez Bernal is a dedicated individual in his academic and professional journeys. He is currently enriching his knowledge in Remote Sensing and Geospatial Sciences at Boston University, with graduation anticipated in May 2024. Sebastian, born and raised in Mexico built a strong foundation in Physics Engineering at Tecnologico de Monterrey. His professional development saw a significant leap forward with his engagement at Spacept, company based in Sweden, where he played a role in enhancing geospatial analysis and software development through various projects. In addition to his professional and academic endeavors, Sebastian has embarked on an entrepreneurial journey as the CEO and Co-Founder of WARPDOC INC. This initiative seeks to simplify the code documentation process for software developers by utilizing machine learning for automation.

Team member 2

- Name (first and last name or first name and last initial): Trenton Mulick
- Hometown: Las Vegas, NV
- A recent picture of yourself or digital avatar (feel free to attach separately):
- Social handle or URL (optional): https://www.linkedin.com/in/tmulick
- Who you are (mini-bio) and what you do professionally:

Trenton is currently a student at Boston University pursuing a master's degree in Remote Sensing and Geospatial Sciences. He focuses on learning how satellites collect remote sensing imagery and how to apply those images to studying the global environment. Specifically, he is focused on studying environmental change as a result of climate change and human impacts. In his free time he can be found hiking and rock climbing around New England.

Team member 3

- Name (first and last name or first name and last initial): Alice Ni
- Hometown: New York City, New York
- A recent picture of yourself or digital avatar (feel free to attach separately):
- Social handle or URL (optional):
- Who you are (mini-bio) and what you do professionally:

Hi! I'm a senior at Boston University pursuing a BA and MS degree focused on geospatial sciences and remote sensing. My interests lie in using technology and data analysis to support current efforts in understanding and modeling dynamic natural processes and climate change. I'm currently working on two projects; one called visualizingEnergy, where the goal is to present data stories to inform and guide an equitable energy transition. The other is with BU's Center for Remote Sensing, where we utilize satellite imagery to map changes in barrier islands and salt marshes along the east coast of the United States.

II. Team submission write-up

The below will provide useful additional context to both the challenge organizers and the broader DrivenData challenge community. Information included in this section may be shared publicly along with challenge results. You can respond to these questions in an e-mail or as an attached file. Please number your responses.

1. What motivated you to compete in this challenge?

The motivation to compete in this challenge is deeply rooted in our commitment to use Remote Sensing and GIS technologies to address climate change. All three of us are graduate students currently learning how to use these technologies to study our environment, and when we found this competition we saw it as a perfect opportunity to not only put our skills to the test but to be able to create a visualization that tangibly advances one of the U.N. Sustainable Development Goals.

2. High level summary of your approach: what did you do and why?

Our approach involved creating a map assessing the suitability of areas in the Turks and Caicos Islands for solar panel installation. We believe that the resulting map meaningfully addresses the Climate Action SDG as it helps create progress on the transition to renewable energy sources and therefore aids in reducing carbon emissions. We chose to focus on the Turks and Caicos Islands because two of our team members have spent time living there studying marine science and saw firsthand how difficult energy generation currently is in some parts of the territory and how the people living there are impacted.

To determine solar panel suitability, we used data on surface temperature, elevation, slope, and the normalized difference vegetation index (NDVI). Surface temperature, elevation, and slope all affect either the efficiency of solar panel energy generation and the ease with which solar panels can be installed in an area. NDVI is used as an estimate of vegetation cover and we determined that areas that are currently highly vegetated would be less suitable for solar panels. This is because of our ultimate goal to address the climate action SDG and these islands have high vegetation coverage and some climatically important ecosystems such as mangrove forests which sequester high amounts of carbon and provide other critical ecosystem services such as shoreline protection. Therefore, we determined that a higher NDVI value indicating higher vegetation cover should lower the suitability score in order to prevent destroying these ecosystems which could offset much of the environmental benefits that solar panels provide.

Elevation and slope came from a raster digital elevation model provided by NASA. Surface temperature and NDVI were calculated from all available Landsat 8 and 9 imagery of the area over the past year and a mean value for each pixel was calculated creating a composite image. We used a year's worth of imagery to account for annual variance in surface temperature and NDVI as well as to limit the influence of cloud coverage in any individual image. For each variable, we then had a raster of data. We could then calculate a score from 1 to 9 for each pixel in the raster of each variable, where 1 corresponds to low suitability and 9 corresponds to high suitability. All 4 of these scored rasters were then compiled together with appropriate weights applied to the 4 variables. This resulted in the final map shown with a score for each pixel.

Ultimately, we chose these variables because of their relevance to solar panel performance and placement as well as the fact that these were freely available or could be derived from freely available satellite data. Additionally, our approach allows for simple integration of other data sources if someone chose to build on our visualization. Data on annual cloud cover or distance from roads, for instance, could easily be incorporated with the data we already gathered to add an additional information source and improve the map.

3. Did you use any tools for visualization, data preparation, or exploratory data analysis that aren't listed in your submission?

No, we listed all the libraries and tools used to developed the project in our original submission.

4. What are some other things you tried that didn't necessarily make it into the final workflow (quick overview)?

We hoped to include some measurements of cloud cover in order to highlight areas that typically have less annual cloud cover leading to higher amounts of solar energy generation. Ultimately, we could not find any spatial data on cloud cover in the Turks and Caicos Islands that could be incorporated into our analysis.

5. If you were to continue working on this problem for the next year, what methods or techniques might you try in order to build on your work so far?

If we were to continue working on this problem over the next year, we would explore several advanced methods and techniques to build on our current work. Firstly, we plan to implement land cover classification techniques using machine learning models, such as deep learning algorithms, to analyze satellite imagery and classify each pixel into one of several land cover classes. By training these models on a diverse dataset, we could improve the precision of identifying suitable areas for solar panel installation by distinguishing between different types of vegetation, urban areas, and water bodies more effectively.

Additionally, we aim to enhance our analysis through cloud cover assessment. This would involve utilizing algorithms that identify cloud cover which would allow us to use images with higher percentages of cloud cover while removing the cloud covered pixels. By incorporating temporal analysis, we could identify patterns and reduce the impact of clouds on our data, ensuring that our surface temperature and NDVI measurements are as accurate as possible. This cloud cover identification could also be used to determine how often each pixel is cloud covered and be another source of information to include in the final map.

Another crucial aspect we plan to add to our analysis is distance to roads and utility grids. This involves evaluating the distance of pixel to existing infrastructure where areas that are closer would be more suitable due to reduced cost and complexity of building solar farms and connecting them to power networks. This accessibility analysis will play a vital role in identifying not only the most suitable locations for solar energy production but also the most feasible ones from a logistical and economic standpoint.

To facilitate this advanced analysis, we would also explore the use of more powerful computational tools and platforms, potentially leveraging cloud computing resources like Google Earth Engine to handle the increased data processing requirements. Collaborating with experts in remote sensing, climate science, and renewable energy systems would also be crucial to enrich our methodology and ensure the applicability of our findings.

Overall, by adopting these advanced methods and techniques, we aim to refine our analysis, provide more accurate recommendations for solar panel placement, and contribute more significantly to the transition towards renewable energy in the Turks and Caicos Islands and beyond.

6. Have any of your team members previously participated in a program funded by the U.S. government? If so, which program?

No, none of our members have participated in a program funded by the U.S. government.