



Questions & Answers Session

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Sativa Cruz (sativa.cruz@nasa.gov), Justin Fain (justin.j.fain@nasa.gov), or Juan Torres-Pérez (juan.l.torresperez@nasa.gov).

Question 1: Is there a way to change your resource allocation once you're in?

Answer 1: Yes. File > Hub Control Panel > Stop My Server > Start My Server. Now you should see the options for environment and resource allocation again.

Question 2: Are there any labels available for this data to train supervised models?

Answer 2: Hopefully this question was answered by the training. We use the "class" labels to train the XGBoost model. Those are the labels you would use in any other supervised classification model.

Question 3: Why is the geojson file excluded?

Answer 3: The geojson is only there to provide the tile footprint. It isn't an image, just the bounding box of the tile. Most of the focus was on AVIRIS next gen.

Question 4: My apologies but i am stuck on accessing the .gpk data in line 13. When I run the code block, it says 'data not found.'

Answer 4: Try using

"/home/jovyan/shared-public/BioSCape_AVIRIS-NG_L3//SAPAD_2024.gpkg" for the file path. The path to the files are now relative and it won't work if you place your notebooks in a different folder. Notebooks should be at
"/home/jovyan/airborne/notebooks"

Question 5: Is this data available for other locations globally?

Answer 5: This data is collected by a sensor on an airborne platform so it is only available in locations where the collection flights have been flown. There is no global airborne data coverage, though there are hyperspectral satellite-based sensors at lower spatial resolution.

Comprehensive list of AVIRIS NG Data can be found here

[Airborne Visible InfraRed Imaging Spectrometer - Next Generation | NASA Earthdata](#)



Question 6: Can you please recommend resources that will help in understanding the code and the overall idea of analyzing satellite data?

Answer 6: There are more tutorials available for processing airborne data here: <https://ornlidaac.github.io/airborne> . There are other resources here <https://nasa-openscapes.github.io/earthdata-cloud-cookbook/> and <https://www.earthdata.nasa.gov/learn>. EMIT also provides data and information to analyze data as well.

Question 7: Will this cloud service be available for us for future use? How can we find hyperspectral imagery for the other region of the world and follow the workflow?

Answer 7: The workshop hub will be temporarily available but you should be able to run this notebook locally or on other platforms such as Google Colab. You can search for NASA Earth observation data at <https://search.earthdata.nasa.gov/search> . You can use the python “earthaccess” module for searching programmatically. Airborne coverage may be limited, but NASA has ISS-based EMIT hyperspectral data available: <https://search.earthdata.nasa.gov/search?q=emit&fi=EMIT%2BImaging%2BSpectrometer>

Question 8: Was this for just one time period in the AVIRIS-NG, or did we load up the whole chunk of time series for the available data?

Answer 8: This dataset was created using flights collected for the time period 2023-10-22 to 2023-11-26. The source data is available at https://search.earthdata.nasa.gov/search?q=BioSCape_AVNG_L2B_BRDF_GCFR_2385

Question 9: How much does it generally cost to initiate an AVIRIS-NG project in an area that isn't already covered in the AVIRIS-NG area? How much extra does it cost to get to L3 data? Does it depend entirely upon the size of a project?

Answer 9: AVIRIS-NG is usually flown for NASA-funded projects. If you are interested in new research areas, please include such requests when submitting the proposals. NASA regularly announces funding opportunities at <https://nspires.nasaprs.com/external/>

Question 10: Can you identify the labeled AVIRIS-NG dataset for species?



Answer 10: If this is in reference to the notebook itself, they are available in the shared area and were a part of the BIOScope workshop cited in the presentation. BIOScope data will be made available on NASA Earthdata collected during the campaign.

Question 11: Is there a minimum size for Area Of Interest (AOI) over which such an approach would be effective? I work for a smaller community looking to track spread of certain invasive plants, but am not sure we have enough area to provide enough training etc.

Answer 11: It should work for smaller training datasets as well, as long as the training datasets are spatially distributed across ecosystems/veg communities. There was a reference made to pixel sizes and resolution in the presentation (18m). If AVIRIS data is not available, it is a matter of figuring out the spatial resolution available for datasets that do cover your AOI. NASA Earthdata Search can also help you look for data available in your AOI (an account is needed for Earthdata Search).

Question 12: Is it realistic to use this resource to track invasive animals?

Answer 12: It would be easier to track invasive animals that leave a mark on their landscape, such as invasive pests which cause damage to specific plant species. Animals move around quite a bit so it is hard to track them with optical remote sensing. See the [ARSET training on animal tracking](#) for some examples of how we track animals with other remote sensing methods.

Question 13: What approach would be good to auto label some of the data to get more training data?

Answer 13: You can probably use some auto-labeling but this training data was collected using manual labelling. Getting more field data can help as well.

Question 14: How much data is available for the Indian region?

Answer 14: AVIRIS-3 is planned for India later this year

https://avirisng.jpl.nasa.gov/planned_campaigns.html

There are a number of AVIRIS instrument flights over India. This [NASA Earthdata search](#) will show AVIRIS instrument data available over India:

[https://search.earthdata.nasa.gov/search?sb\[0\]=67.42467%2C7.32004%2C90.41876%2C32.3006&fpj=AVIRIS&lat=24.1925271485129&long=82.26186124455548&zoom=4.779924087048677](https://search.earthdata.nasa.gov/search?sb[0]=67.42467%2C7.32004%2C90.41876%2C32.3006&fpj=AVIRIS&lat=24.1925271485129&long=82.26186124455548&zoom=4.779924087048677)

Question 15: Can you explain more about the tuning parameters we used for XGBoost?



Answer 15: There is far too much to go over and explain in the space of this Q&A session. You can find great resources online to learn more such as [this documentation](#).

Question 16: Is it possible to spectrally super-resolve one hyperspectral image (for example, 10 broad bands to 100 bands by considering the nm interval)?

Answer 16: We will look into this further.

Question 17: Are there any open source spectral libraries other than USGS, ASTER, etc. for invasive species?

Answer 17: In addition to NASA Earthdata, there are openly available spectral libraries at <https://ecosis.org/>.

Question 18: If we had 5 years of AVIRIS-NG data, how would this workflow change if we were interested in the range of spectra across a specific phenology period within the 5 years of AVIRIS campaign?

Answer 18: NASA SHIFT is a campaign (<https://www.earthdata.nasa.gov/data/projects/shift>) that has a lot of data available that is relevant to this topic.

Question 19: Can I use the SAM with some threshold limit to filter the spectral signatures to make the training data for training dl models? How can I set the threshold values for SAM?

Answer 19: You should be able to use Spectral Angle Mapper (SAM) to threshold limit. The threshold values will probably need some testing based on the area of interest. It is also dependent on your research and your application area.

Question 20: Can this methodology be applied to data from hyperspectral satellite sensors? What would be recommended sensors and how would the spatial scale change? What about Synthetic Aperture Radar (SAR) and optical data?

Answer 20: Yes. A recommended NASA satellite-based hyperspectral data is EMIT. <https://earth.jpl.nasa.gov/emit/>. We have not tested this workflow with SAR or optical data. PACE is also a relevant satellite that could help in your research. We also have an ARSET training that highlights the PACE mission as well.

Question 21: Can I use the spectra of the species which were collected for US species to study the same species grown in India with the available AVIRIS-NG data captured during the NASA-ISRO campaigns 2015, 2016, and 2018?



Answer 21: The spectra shouldn't change species to species and the classifications should still work.

Question 22: Can this workflow and python notebook potentially be adapted for UAS imagery? We have a 5-band multispectral camera we attach to our UAS so we would be working with low spectral res and high spatial resolutions.

Answer 22: If you have a higher spatial resolution, segmentation can help to look at the shape of imagery with low spectral resolution. Hyperspectral data can also help with bridging the gap as well.

Question 23: When applying the machine learning training model, do you need to mask the training plots so you are only classifying test/evaluation pixels?

Answer 23: In the tutorial, we didn't mask to training plots, but selected AVIRIS data that was over the training plots. We applied a mask to natural areas to help clean up the results. XGBoost only trains on a subset of the data at each step (configurable with hyperparameter tuning) so the final model is robust to overfitting and shouldn't present much issue when predicting the classification over the "reused" training points. Just aim for high variation in the training data to minimize potential issues.

Question 24: Is it possible to create 3D models using the overlap of AVIRIS-NG data? Can 3D canopy models be generated for individual species?

Answer 24: The species level is very difficult to do from AVIRIS data. It is very reliant on knowledge based in situ data. Very high resolution data is also needed as well. LVIS (<https://search.earthdata.nasa.gov/search?q=lvis&fi=LVIS&fpj=BioSCape>) is also data that can be useful for this application.

Question 25: Can I reproduce this for any place in the USA? Do you know if there are other missions like that outside South Africa with data available?

Answer 25: There is a good amount of AVIRIS-NG data in the US, but the coverage is not coast-to-coast. The Jet Propulsion Laboratory has a good overview of [AVIRIS flight paths over the contiguous US](#). This dataset will provide a comprehensive access to all of the AVIRIS-NG data (the Facility Instrument collection). [AVIRIS-NG L2 Surface Reflectance, Facility Instrument Collection, V1](#). If you are looking for hyperspectral data with global coverage you will need to look at satellite-based sensors, though these will have lower spatial resolution than sensors on airborne platforms.

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Question 26: What is the refresh interval for the AVIRIS data?

Answer 26: AVIRIS data is collected by flying the instrument over the area of interest. As such, it doesn't have a revisit period like you would have with an orbital sensor. The temporal resolution is directly related to when and how many times the sensor was flown. A lot of this data is provided through the NASA Airborne Program. If looking for a "regular" return, NEON has a similar instrument that does have a regular return rate over NEON sites. NEON is funded through a separate federal program.

Question 27: How would this process be influenced by tackling the probability mapping of invasive shrub species?

Answer 27: You should find that the process is very similar aside from any particular complications of your study site (such as overlying vegetation/canopy cover). If your invasive species is spectrally distinct from the background then you should be able to use classification to find it in the landscape.

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Question 30: Are there comparable international programs with open data sources (like ESA, DLR, JAXA, etc.)?

Answer 30: ESA has similar airborne instrument called Airborne Prism Experiment (APEX). <https://apex-esa.org/en>



Question 31: Can you merge data from NASA and, say, the EU from the Copernicus space ecosystem?

Answer 31: There are challenges with migrating and integrating data into the cloud and having different hosting environments can pose a challenge to data compatibility. If you can bring the data together, you should be able to merge it. We can also mention MAAP program which tried to bring data and codes together between NASA/ESA, <https://www.earthdata.nasa.gov/about/maap>

Question 32: Is there a library of reflectance of species that we can use?

Answer 32: You can find details about [ECOSTRESS](#) here. [ECOSIS](#) is another source. There is also an [ARSET training](#) that highlights ECOSTRESS from a while ago.