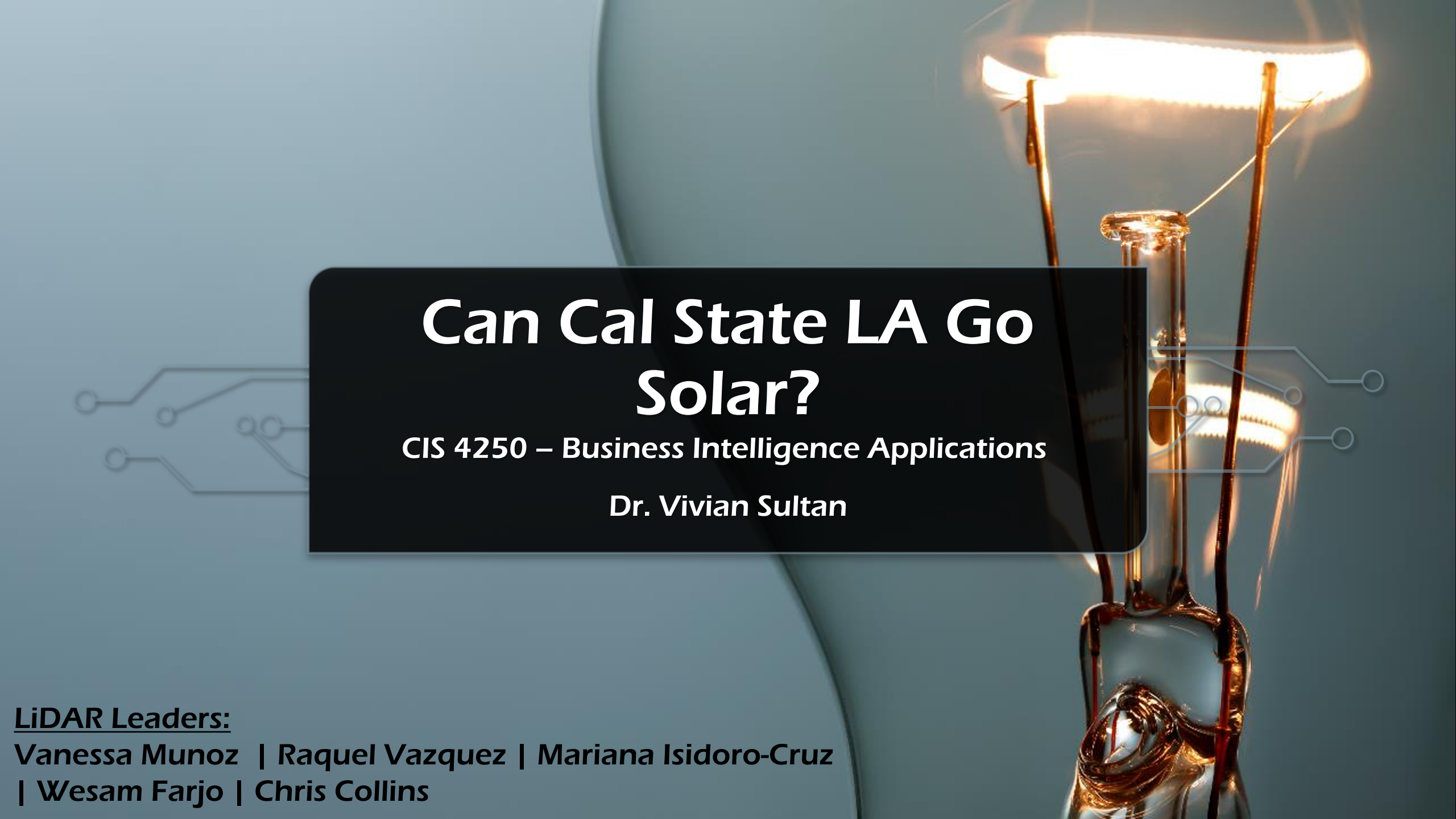
Can Cal State LA Go Solar?

CIS 4250 – Business Intelligence Applications

Dr. Vivian Sultan



LiDAR Leaders:

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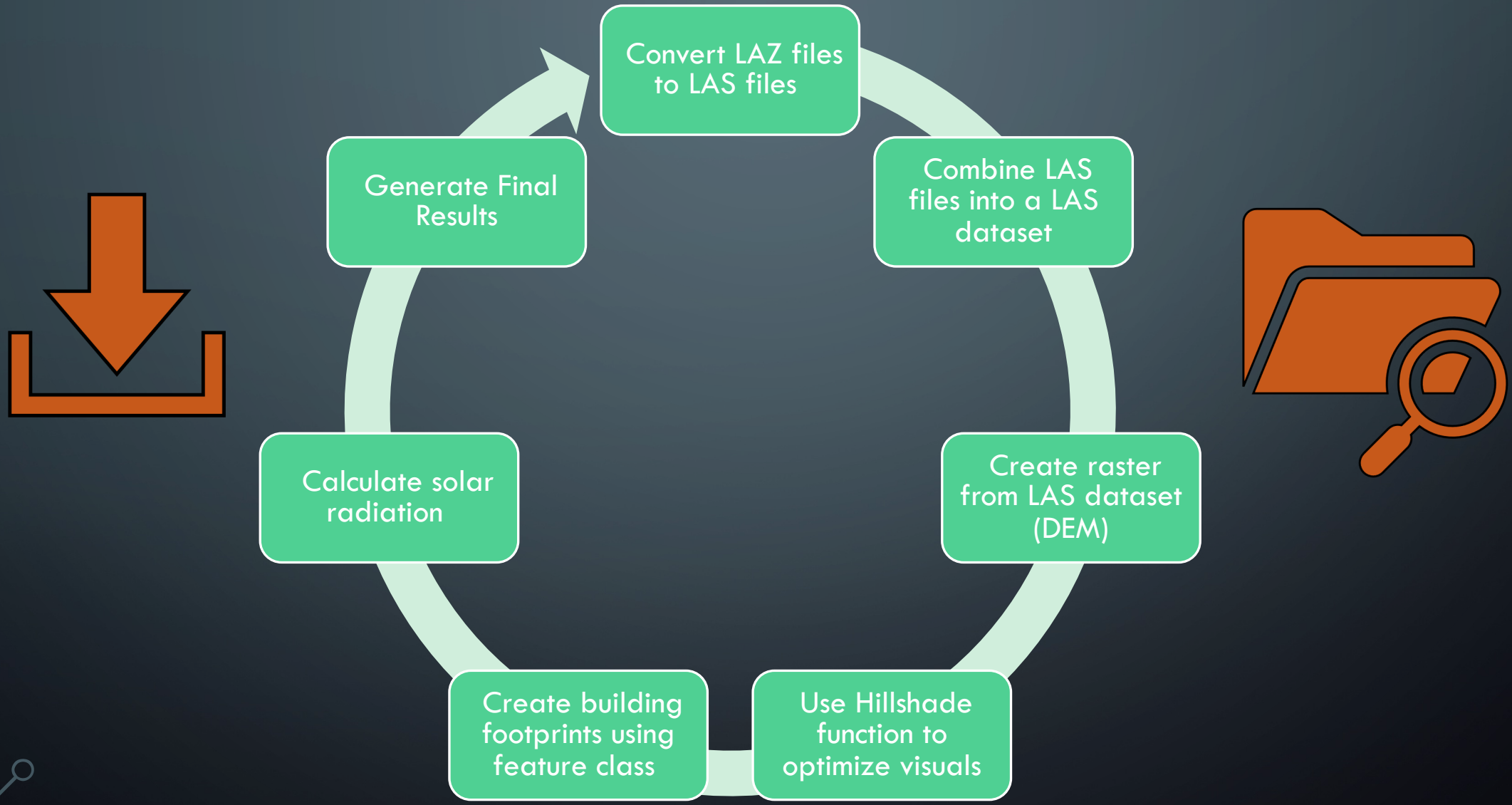
AGENDA

- Project Definition
- ArcGIS Pro Implementation
- Expectation of Analysis
- LiDAR Dataset
- Literature Review
- Real Life Example
- Geospatial Tools in Analysis
- ArcGIS Pro Implementation
- Project Outcome
- Project Limitations
- References
- Questions

PROJECT DEFINITION

LiDAR Leaders are on a mission to measure the possible amount of green energy that can be produced at the CSULA campus, and if it is sufficient to go solar using ArcGIS Pro remote sensing tools

ArcGIS Pro Implementation



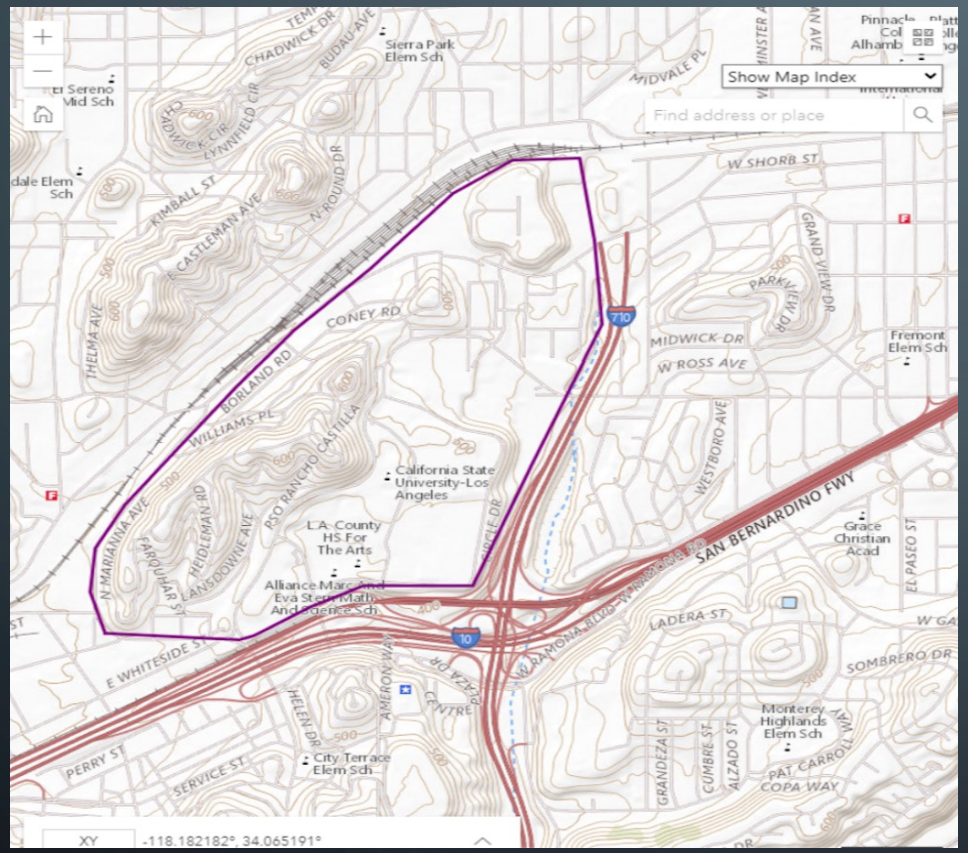
EXPECTATION IN ANALYSIS

The goal is to conduct research and analysis using LiDAR data to determine whether Cal State LA can go solar or not

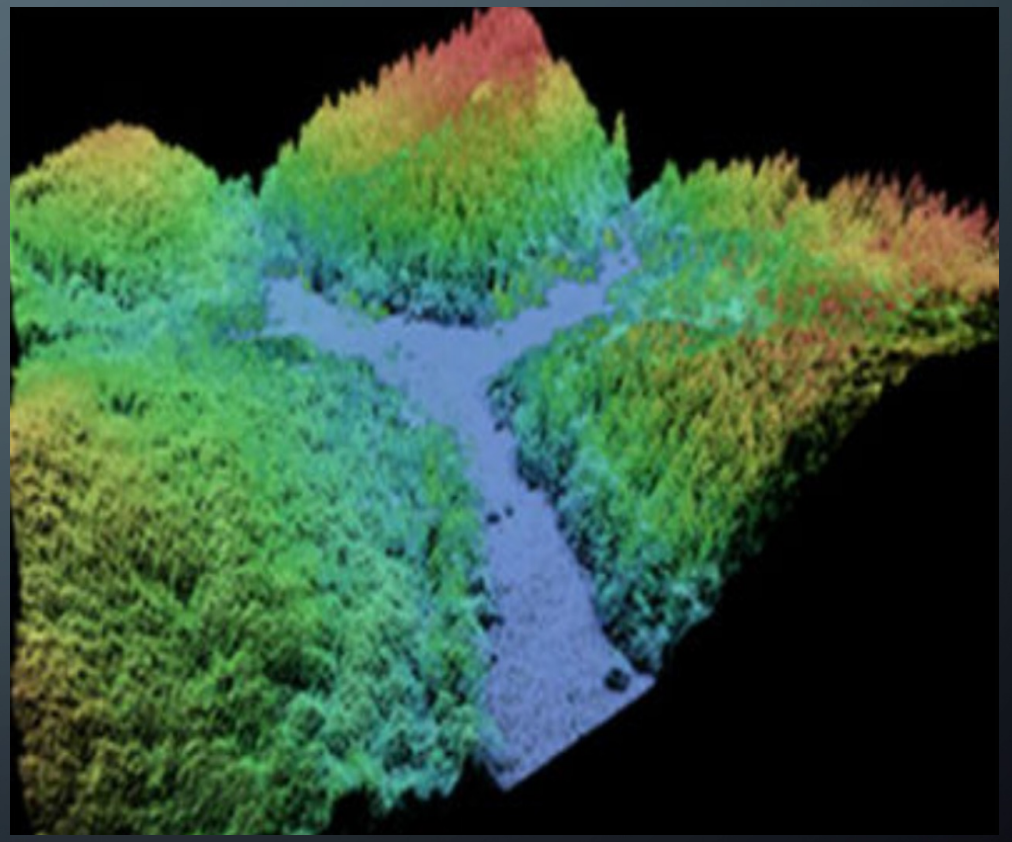
The end results offer an insight on solar power generation output and what it can be used for

LIDAR DATASET

- USGS Data source https://apps.nationalmap.gov/downloader/#/
- Narrowed the scope area on Cal State LA



MAP OF CAL STATE LA



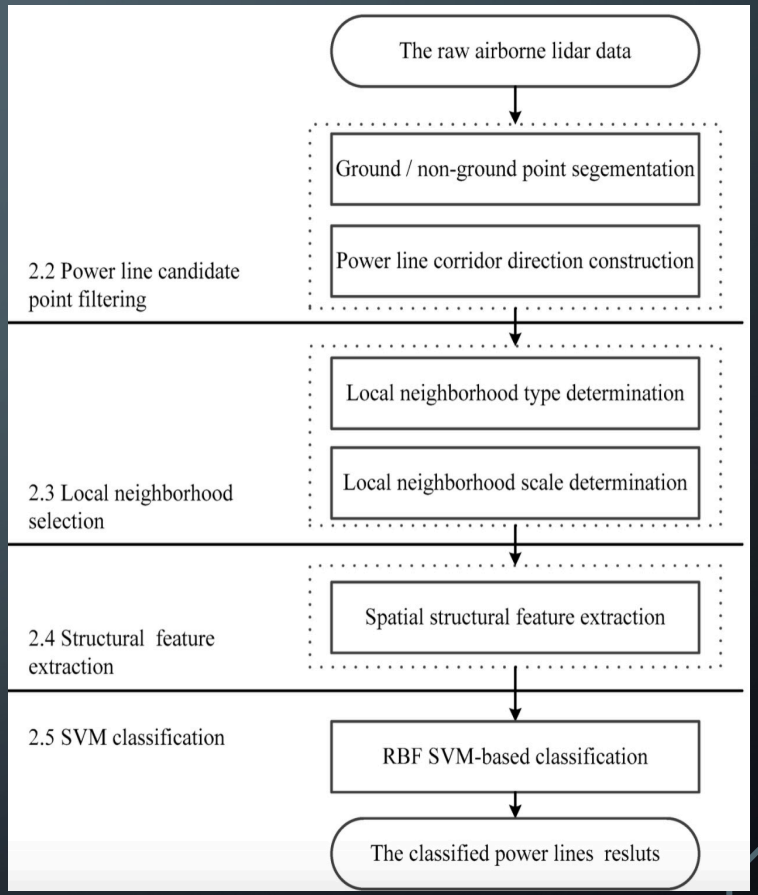
SAMPLE ELEVATION MODEL

LITERATURE REVIEW

WANG, YANJUN, QI CHEN, LIN LIU, DUNYONG ZHENG, CHAOKUI LI, AND KAI LI. (2017):

"SUPERVISED CLASSIFICATION OF POWER LINES FROM AIRBORNE LIDAR DATA IN URBAN AREAS"

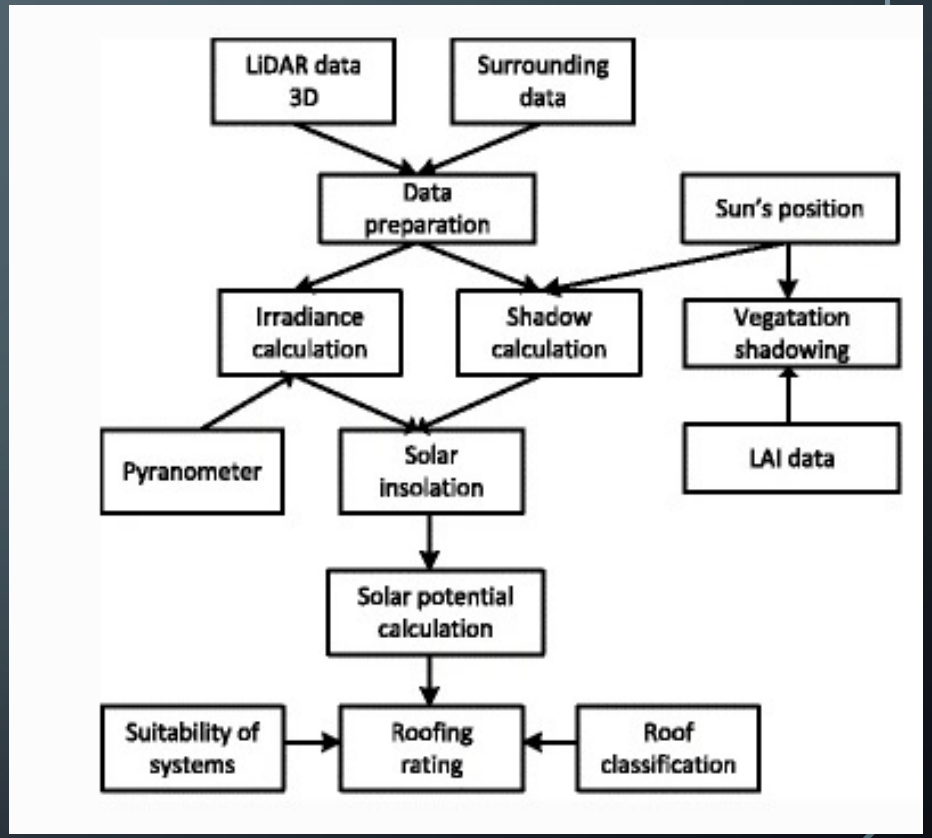
- Scope: Airborne LiDAR (light detection and ranging) data to collect high-precision 3D point cloud data of the power line corridor
- Study Area: Urban area surrounding the campus of University of Hawaii in Honolulu, Hawaii
- Research Contribution: The development of highly efficient methods for extracting urban power lines from airborne LiDAR point cloud data



LITERATURE REVIEW CONT.

DAWOOD, N., DAWOOD, H., RODRIGUEZ-TREJO, S., & CRILLY, M. (2017). VISUALISING URBAN ENERGY USE: THE USE OF LIDAR AND REMOTE SENSING DATA IN URBAN ENERGY PLANNING.

- Scope: LiDAR data of rooftops to show probability of integrating renewable energy
- Study Area: United Kingdom
- Research Contribution : Big data analysis algorithms to resolve the issue



REAL LIFE EXAMPLE

USGBC (2014). ***Green Professional Building Skills Training***

San Diego State University integrated solar panels, sensor and a system management to the student recreation center

- Savings: $36K plus 246,000 kilowatts
- Cost: $70K

GEOSPATIAL TOOLS IN ANALYSIS

ArcGIS Pro (Primary)

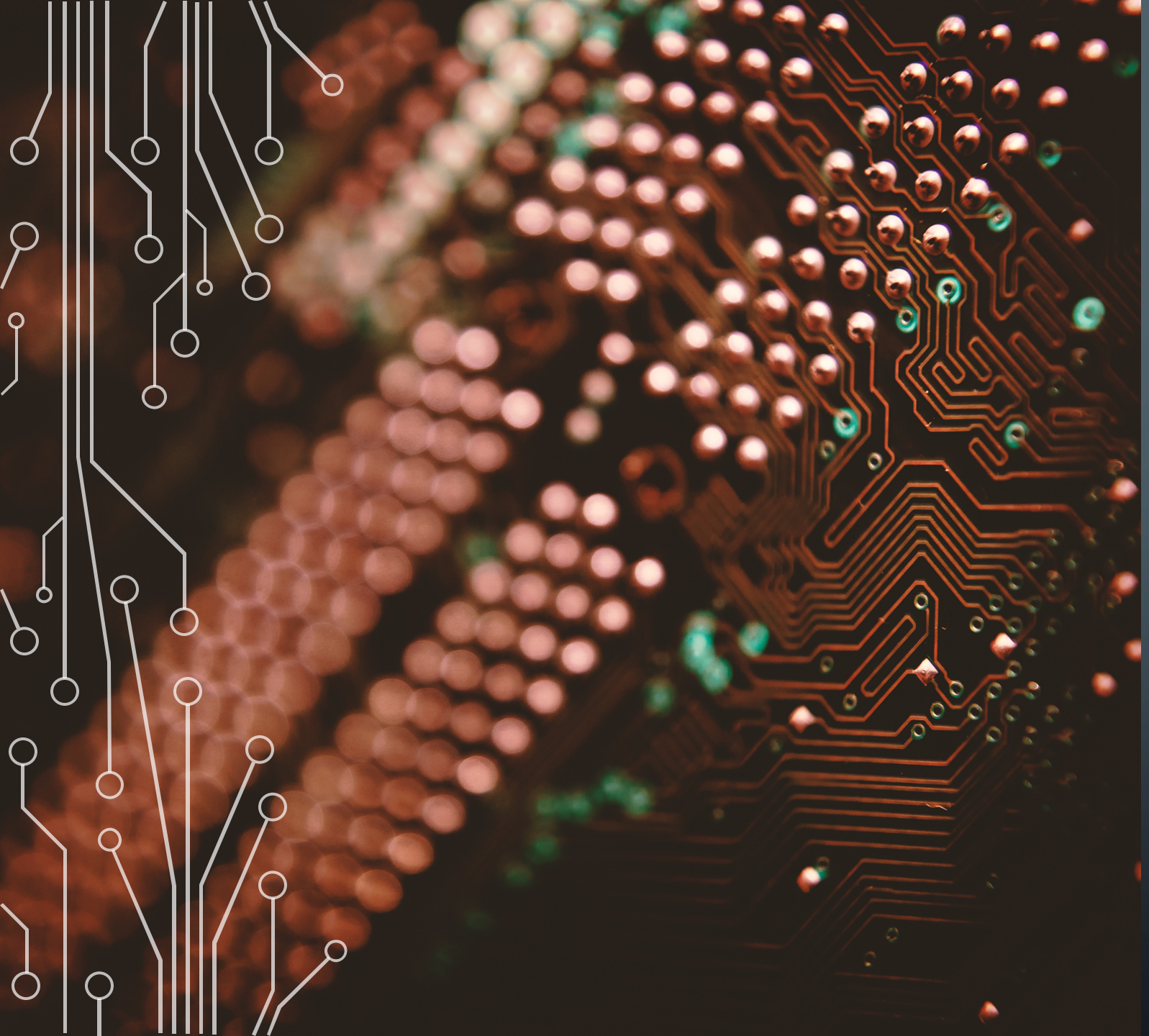
- Map Visualizations
- Data Processing

ArcGIS Online (Supportive)

- Map Layout
- Project Sharing

GIS Remote Sensing

- Elevation Model
- USGS Map Downloader

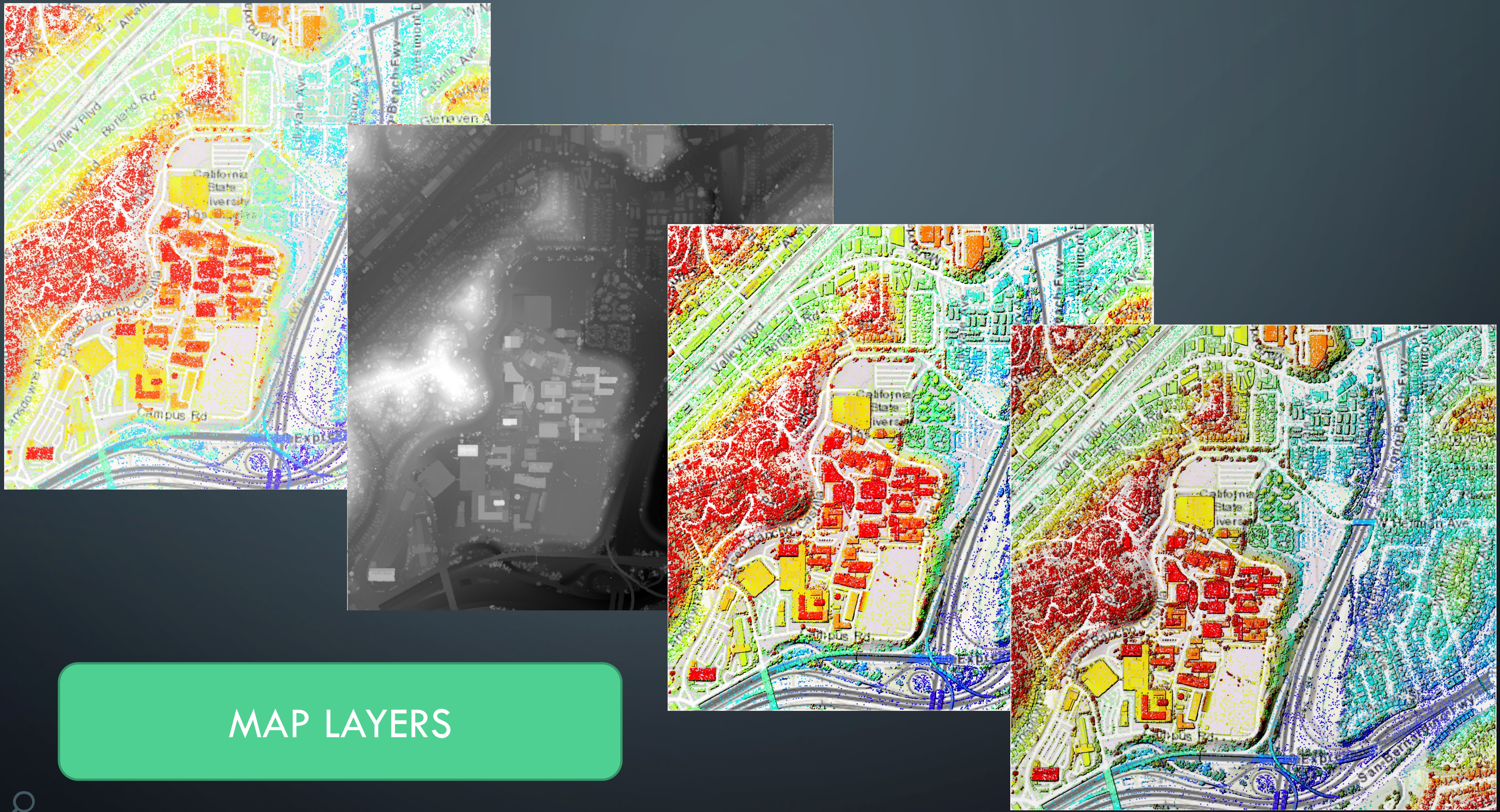


ArcGIS Pro

- Map Visualization
- Geoprocessing
- Raster Functions
- Pro Features

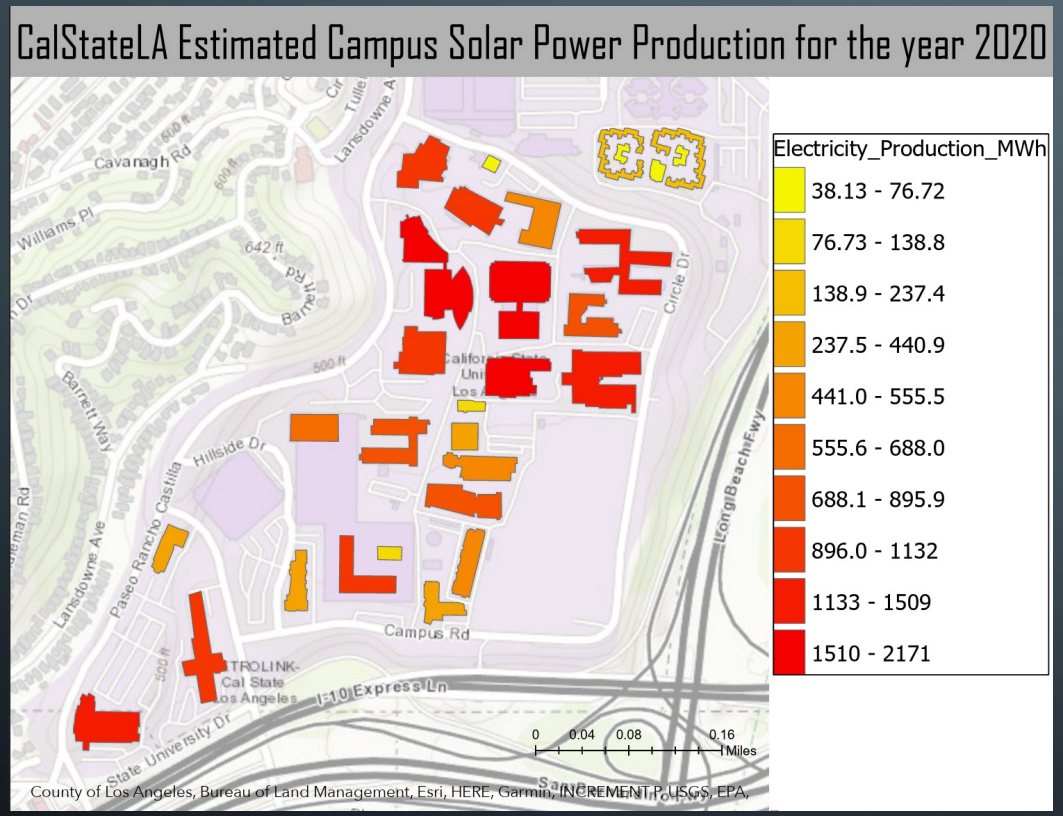
PROJECT IMPLEMENTATION (MAP PROCESSING TOOLS)

- *Convert LAS*
- *Create LAS Dataset*
- *LAS Dataset To Raster*
- *Hillshade Raster Function*
- *Create Feature*
- *Area Solar Radiation*
- *Calculator*



MAP LAYERS

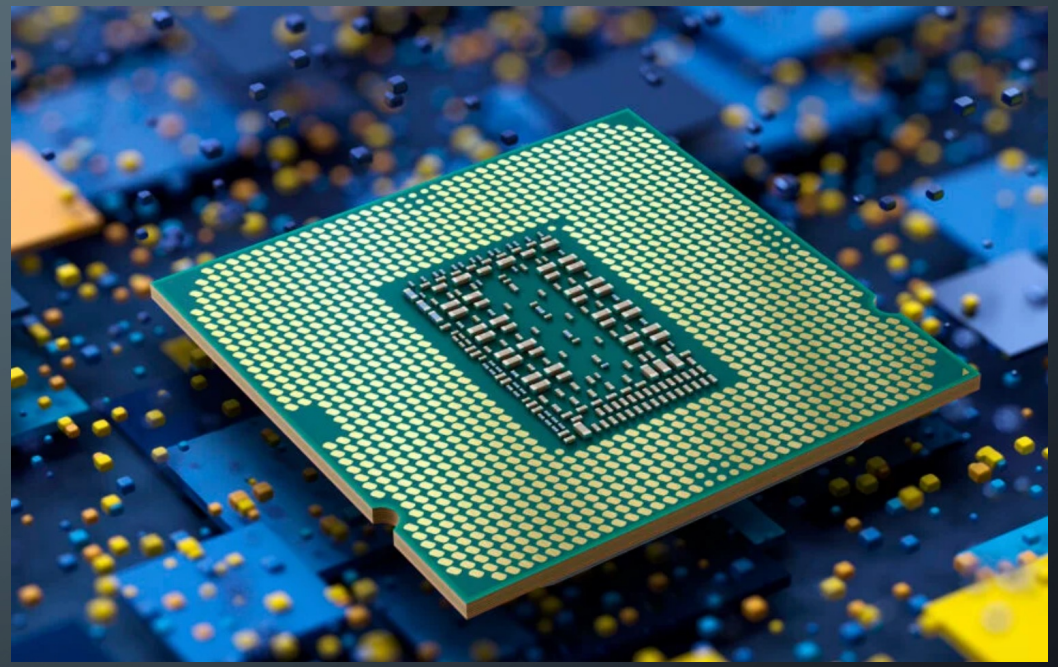
PROJECT OUTCOMES



Estimated Total Usable Area (Buildings only)	901,969 ft^2
	83,789.6 m^2
Estimated Total Solar Radiation (Buildings only) For The Year 2020	180,740 MWh
Estimated Possible Power Production For The Year 2020	23,315.5 MWh

PROJECT LIMITATIONS

- Hardware capabilities (PC)
- Lack of CSULA 2020 energy consumption data



LA County Solar Map Application Information

Area Suitable for Solar:
1,095,417 Sq. Ft.

Electricity Produced:
27,437,684 kWh/year

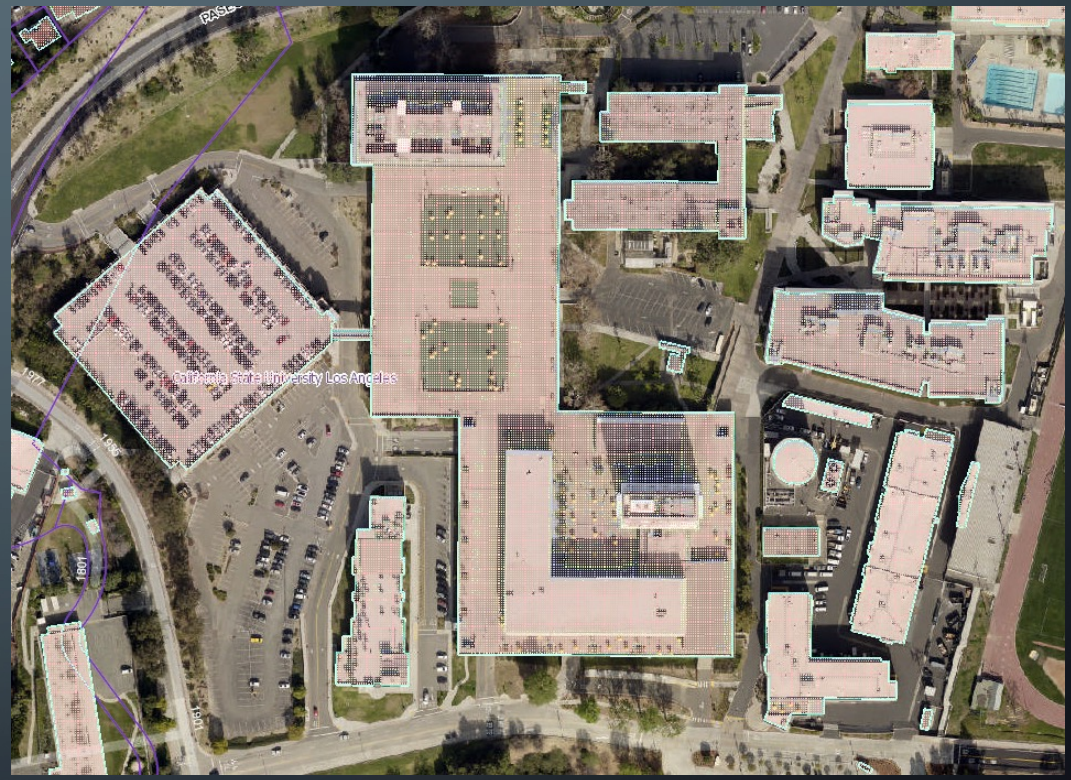
RESULTS EVALUATION

Compared Results To Estimates From LA County Solar Map Data Source

	Area Suitable for Solar ft^2	Estimated Electricity Production kWh/year	Area Suitable for Solar m^2	Estimated Electricity Production MWh/year
LiDAR Leaders	901,969	23,315,500	83,795.66	23,315.5
LA County Solar Map Application	1,095,417	27,437,684	101,767.57	27,437.7
Variance	193,448	4,122,184	17,972.91	4,122.2

LiDAR LEADERS MODEL SHOW HIGHER ACCURACY

LiDAR Leaders Model



LA County Model

CAN CalStateLA GO SOLAR AND BE SELF-SUFFICIENT TO OPERATE INDEPENDENTLY FROM THE ELECTRIC GRID?

CSULA Power consumption estimates can be found in the cal_state_la_2019_climate_action_plan_-_final_online_version on page 11 section 2.2
https://www.calstatela.edu/sites/default/files/groups/Sustainability/cal_state_la_2019_climate_action_plan_-_final_online_version.pdf

PROJECT CONCLUSION

CalStateLA cannot go entirely solar and completely independent from the electric grid even if the campus utilizes the entire available area for solar panel

Estimated Area for Solar Panels	Estimated Solar System Power Production	Estimated Campus Power Consumption	Estimated Unmet Power Demand
901,969 ft2	23,315,500 kWh / year	35,500,000 kWh / year	12,184,500 kWh / year

References

Wang, Y.; Chen, Q.; Liu, L.; Zheng, D.; Li, C.; Li, K. Supervised Classification of Power Lines from Airborne LiDAR Data in Urban Areas. *Remote Sens.* 2017, *9*, 771. https://doi.org/10.3390/rs9080771

Sounny-Slitine, M. A. (n.d.). *Potential of Solar Power on the University of Texas Campus*. (2011) academia.edu. https://www.academia.edu/1038042/Solar_Power_Potential_on_the_University_of_Texas_Campus_LiDAR_Solar_MappingLkVGN6NEr~l777oHraL81oqd7tdkrYIvA42sWwJyMRIA__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA.

Dawood, N., Dawood, H., Rodriguez-Trejo, S., & Crilly, M. (2017). Visualising urban energy use: the use of LiDAR and remote sensing data in urban energy planning. Visualization in Engineering, *5*(1), 1–13. https://doi.org/10.1186/s40327-017-0060-3

Urban Green Council. (2014). ***Green Professional Building Skills Training*. U.S. Green Building Council New York.**

References

LA County. (n.d.). *LA County Solar Map Application*. Geocortex viewer for HTML5. https://apps.gis.lacounty.gov/solar/m/?viewer=solarmap.

U.S. Energy Information Administration (EIA). (n.d.). *Green Power Equivalency Calculator - Calculations and References*. EPA. https://www.epa.gov/greenpower/green-power-equivalency-calculator-calculations-and-references.

CalStateLA. (2019). cal_state_la_2019_climate_action_plan_-_final_online_version. Los Angeles; CalStateLA.

Questions?

THANK YOU!

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