A Smart Light-Tracker Using Machine Learning and Dye-Sensitized Solar Cells

Mukherji, Malini

In this project I investigated whether variations in current caused by difference in the angle and intensity of a light incident upon solar cells can be utilized to design an “intelligent” solar panel that can predict the position of the light source. Dye-sensitized solar cells were used due to the ease with which they can be fabricated at home and their responsiveness to low ambient light conditions. Several configurations of solar panels were tested, out of which a semi-spherical configuration which used five DSSCs, yielded the best inter-cell variations of short-circuit currents. The electrical response of each cell in the array was different for different locations of a source of light pointed towards this configuration. These electrical response values were recorded and the data, along with the positional information of the light source, were used to train two supervised, logistic regression Machine Learning models, one for the zenith angle and one for the azimuth angle of the light source. The generated model was then used to predict the zenith and azimuth angles of an incandescent light source pointed at the array. The non-feature-mapped models generated learning accuracy rates of 90% and 60% for azimuth and zenith angles, respectively, and test data accuracies of 50% and 46%, respectively. These numbers were improved upon by using feature-mapped models that generated learning accuracy rates of 100% and 98%, respectively, and test data accuracies of 77% and 67%, respectively. The novelty of this work lies in the use of individual solar cells as the data source for machine learning algorithms – we have found no prior work that has used machine learning models as the tool for recording knowledge about light-source positions and subsequent real-time predictions.

Awards Won:

Third Award of $1,000

American Statistical Association: Certificate of Honorable Mention