**Crop Paper**

A graph with different colored squares

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A screenshot of a graph

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1. (b)

Figure: Shap Algorithms for 2003-2007 data

Shap Algorithms are defined as the mean marginal impact of an individual feature value on all potential feature combinations, as used in coalitional game theory. They calculate the influences of each feature by taking into account all possible combinations and contributions. It offers local interpretability by revealing the model’s output for particular predictions and determining the Shapley value for the feature related to that prediction where it assigns a weight to each feature to explain how the model finds the divergence of a given prediction from the initial value.

In this study, several factors have influenced the crop yields. The feature defines which factor most impacts crop growth. From Figure (a), by applying Shapley algorithms to 2003 to 2007 data, we conclude that precipitation or significant rainfall mostly helped crop yield. Again in Figure (b), we have used Shap on the precipitation level and our model shows that the higher precipitation caused more crops to yield.

A screen shot of a graph

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1. (b)

Figure: Shap Algorithms for 2008-2012 data

From Figure (a), our analysis of 2008-2012 data again showed that precipitation had the highest influence on crop yield and temperature had the second largest contribution on crop yield. From Figure (b), “precipitation class high” had a major impact whereas “very high” had the lowest impact among all.

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(a) (b)

Figure: Shap Algorithms for 2013-2017 data

Surprisingly, the data from 2008-2012 showed a different result. The analysis showed that among those years temperature had the most impact on crop growth surpassing precipitation in Figure (a). From figure (b), Medium temperatures brought more crop yield, and high temperatures provided lower yield compared to other levels.

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(a) (b)

Figure: Shap Algorithms for 2018-2022 data

Lastly, for recent crop data from 2018-2022, our Shap analysis in figure (a) showed that precipitation again outperformed in terms of contribution to the crop yield. Temperature had the second highest contribution to the crop yield and it was close to the precipitation. Further analysis of the precipitation level in Figure (b) showed that the crop yielded better when the precipitation was low and worse when it was very high.