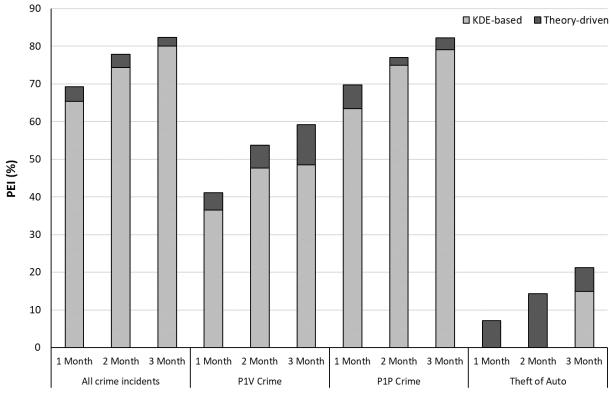**APPENDICES**

APPENDIX A. General description of the NIJ's Real-Time Crime Hot Spot Forecasting

The National Institute of Justice (NIJ) in the United States hosted the *Real-Time Crime Forecasting Challenge* in 2017 and encouraged scholars across all scientific disciplines to foster innovation in forecasting methods. The Portland Police Bureau in Oregon provided calls for service data from March 2012 to February 2017 and participants were asked to forecast crime hot spots for four types of incidents (burglary, motor vehicle theft, street crime[1], and all calls for service) over the months of March, April, and May of 2017. Considering geographical constraints of the city, participants were also asked to define both size and shape of the grid cells spatially overlaid on the city of Portland. Finally, participants were asked to rank the most likely grid cells that would turn into hot spots during the forecasted months. Unlike conventional forecasting research which uses pre-generated datasets for analysis, this competition was a true prospective forecasting test with the validation data set not generated at the time of submission. So, we predict the spatial patterns of hot spots without having the data for those months to validate our results. Forecasts were made for 1-month, 2-month, and 3-month time windows, and the NIJ scored our forecasting results based on both efficiency and accuracy.

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[1] Street crime includes assault, disturbance, gang related crime, robbery, shooting, stabbing, threat, and vice crimes (drugs, liquor, prostitution, and gambling).

APPENDIX B. Prediction Accuracy Index (PAI) values of the crime hot spot forecasting algorithm for Portland, Oregon

Type of Crime	Forecasting Period		
	1 month	2 months	3 months
Calls for Service	25.7	25.6	25.3
Street Crime	36.0	35.5	36.3
Theft of Auto	15.3	14.3	15.5
Burglary	11.1	8.6	9.9

APPENDIX C. A comparison of PEI values between the KDE-based forecasted hot spots and the theory-driven forecasted hot spots for Cincinnati, Ohio