Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

HSB
Hochschule Bremen
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Master 2016

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In-Network Data Analysis of Spatially Distributed Quantities.

ABSTRACT - Masterthesis

The Kernel/Local regression (LOESS) algorithm is widely used for estimating a regression function over a domain of one, two or more dimensions and with degrees constant, linear, square and more on noisy data observations. This technique has to be fitted for each query point in the irregular data and then the resulting estimated function is smoothed. This estimation is achieved by using kernel function which assigns a weight to each data point based on its geometrical distance from the target point.

Our aim is to smooth the noise in the temperature data inside reefer containers. Temperature deviations are caused by variations of the air flow between the pallets. They are sensed by the wireless sensor network, which is placed for controlling the damage of food or meat during the transport in the containers. To achieve this purpose a good estimation of noisy data signal is necessary. These algorithms are developed from the motivation of 'k' nearest neighbor approach, which depends on squared distance calculation between nearest neighbor data points from target data point within a selected window length (lambda). Kernel functions (Epanechnikov and Tri-cube) are applied to each obtained data point and substituted in most popular Nadaraya-Watson kernel weighted average.

Finally the data with noise is smoothed and compared with the original clean data to evaluate the root mean square error. Then the best fit degree (constant, one or two) with low error is selected.

Kernel methods do only smoothing, but no data compression. For wireless communication the number of the transmitted parameters should be reduced. Therefore, the smoothed data are fitted by a simple model, e.g. by Radial Basis Functions.