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Heteroscedastic Gaussian Process regression for assessing interpolation uncertainty of essential climate variables

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Recent advancements, [2][3], in interpolation uncertainty estimation for the vertical profiles of ECV (essential climate variables), have shown the Gaussian process regression to be a valid interpolator. Gaussian process regression assumes the variance to be constant along the atmospheric profile. This behaviour is known as the homoscedasticity of the residuals.
However, climate variables often present heteroscedastic residuals. The implementation of Gaussian process regression that accounts for this latter aspect is a plausible way to improve the interpolation uncertainty estimation. In [2], these authors recently showed that Gaussian Process regression gives an effective interpolator for relative humidity measurements, especially when the variability of underlining natural process is high.
In this talk, we consider Gaussian methods that allow for heteroscedasticity, e.g. [1], hence handling situations in which we have input-dependent variance. In this way, we will provide a more precise estimate of the interpolation uncertainty.

References

[1] Wang C., (2014) Gaussian Process Regression with Heteroscedastic Residuals and Fast MCMC Methods, PhD thesis, Graduate Department of Statistics, University of Toronto.
[2] Colombo, P., and Fassò A., (2021) Joint Virtual Workshop of ENBIS and MATHMET Mathematical and Statistical Methods for Metrology, MSMM 2021.
[3] Fassò, A., Michael S., and von Rohden C. (2020) "Interpolation uncertainty of atmospheric temperature profiles.", Atmospheric Measurement Techniques, 13(12): 6445-6458.

Keywords

Gaussian process, Heteroscedasticity, Uncertainty estimation, GRUAN, Humidity profiles

Special/invited session

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