



# Gaussian process models for periodicity detection

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We consider the problem of detecting the periodic part of a function given the observations of some input/output tuples  $(x_i, y_i)$ . As they are known for being powerful tools for dealing with such data, our approach is based on Gaussian process regression models which are closely related to reproducing kernel Hilbert spaces (RKHS). The latter offer a powerful framework for decomposing covariance functions as the sum of periodic and aperiodic kernels. This decomposition allows for the creation of sub-models which capture the periodic nature of the signal and its complement. To quantify the periodicity of the signal, we derive a periodicity ratio which reflects the uncertainty in the fitted sub-models. Although the method can be applied to many kernels, we give a special emphasis to the Mat\ern family, from the expression of the RKHS inner product to the implementation of the associated periodic kernels in a Gaussian process toolkit. The efficiency of the proposed method is finally illustrated on a biological case study where we detect periodically expressed genes.

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