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## Asymptotics for penalized splines

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Algorithmic complexity is a very important topic in computer science. Knowing the complexity of algorithms allows you to answer questions such as “How long will a program run on an input?”, “How much space will it take?” and “Is the problem solvable?”. These are important bases of comparison between different algorithms. An understanding of algorithmic complexity provides programmers with insight into the efficiency of their code.

We perform an asymptotic analysis of penalized spline estimators. We compare P-splines and splines with a penalty of the type used with smoothing splines. A P-spline and a smoothing spline are asymptotically equivalent provided that the number of knots of the P-spline is large enough, and the two estimators have the same equivalent kernels for both interior points and boundary points. We consider the convergence of the algorithm as well as the uniqueness of its solution.

Also, we develop asymptotic theory with quasi-solution for penalized spline estimators in generalized additive models. Our purpose is to establish the asymptotic bias and variance as well as the asymptotic normality of the penalized spline estimators proposed by Marx and Eilers.

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