FACULTY
OF INFORMATION
TECHNOLOGY
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# Assignment of master's thesis

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| **Title:** | Performance and robustness analysis of Bayesian filters |
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| **Supervisor:** | Ing. Kamil Dedecius, Ph.D. |
| **Study program:** | Informatics |
| **Branch / specialization:** | Knowledge Engineering |
| **Department:** | Department of Applied Mathematics |
| **Validity:** | until the end of summer semester 2022/2023 |

## Instructions

Sequential (online) inference of state-space models usually assumes that the models are well specified. In particular, it means that the measurement and process noise covariances are known and correctly set. By design, the most popular family of filters - the Kalman filters - is highly sensitive to misspecifications. The particle filters, on the other hand, are quite robust. However, the price for this robustness is the associated computational burden. Third, there are so-called approximate Bayesian filters, that stem from the particle filters, but admit complete ignorance of the measurement noise distribution.

The goals of the thesis:
1) Study the theory of the (nonlinear) Kalman, particle, and approximate filters.
2) Compare their performance and robustness under well-specified models.
3) Compare their performance and robustness under misspecified models.

References:
D. Simon, Optimal state estimation: {K}alman, {H}-infinity, and nonlinear approaches. Wiley-Interscience, 2006.
K. Dedecius, "Adaptive kernels in approximate filtering of state-space models," Int. J. Adapt. Control Signal Process., vol. 31, no. 6, pp. 938–952, Jun. 2017.
A. Jasra, S. S. Singh, J. S. Martin, and E. McCoy, "Filtering via approximate Bayesian computation," Stat. Comput., vol. 22, no. 6, pp. 1223–1237, May 2012.

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*Electronically approved by Ing. Magda Friedjungová, Ph.D. on 10 May 2022 in Prague.*