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Combining reinforcement learning with data assimilation for individualised dosing policies

Abstract:

In clinical practice, therapy individualization based on therapeutic drug/biomarker monitoring offers the opportunity to significantly improve the efficacy and safety of many drug treatments. Mathematical models describing the pharmacokinetics and pharmacodynamics of the drug can be leveraged to support decision-making by predicting therapy outcomes. We present a continuous learning strategy that allows to improve and individualize the considered model as well as the dosing policy. For this, the model parameters and states are sequentially updated via a particle-based Bayesian data assimilation (DA) scheme when new patient-specific data is observed. This updated model can subsequently be used in a model-based reinforcement learning (RL) step (planning) to tailor the dosing policy to the specific patient. An additional direct RL step allows to correct for potential structural model bias.