Inertial navigation systems suffer from drift errors that degrade their performance. Main current techniques mitigate such errors by detecting stance phases under the specific context of pedestrian walking with a foot-mounted inertial measurement unit (IMU). Existing approaches achieve acceptable performances only in simple circumstances, such as smooth movements and short periods of time. In addition, they lack a principled unifying methodology to exploit contextual information. In this paper, we establish a general framework for context-aided inertial navigation, and present efficient algorithms for its implementation based on the inference technique called belief condensation (BC). The performance of the proposed techniques is evaluated against the state of the art through an experimental case study. Our results show that the proposed techniques can remarkably improve the navigation accuracy while keeping moderate complexities.