Integration of Extended Kalman Filter and Neural network for Foot-mounted Pedestrian Navigation

Guang-Je Tsai[1] Yuan-Rong Sih[2] Hone-Jay Chu[3] Kai-Wei Chiang[4]

[1] Master student, Department of Geomatics, National Cheng Kung University
No.1, University Rd., Tainan City 70101, Taiwan; Tel: + 886-6-2373876#852;
E-mail: tpp1114@gmail.com

[2] Master student, Department of Geomatics, National Cheng Kung University
No.1, University Rd., Tainan City 70101, Taiwan; Tel: + 886-6-2373876#852;
E-mail: isoraaoi20@gmail.com

[3] Assistant Professor, Department of Geomatics, National Cheng Kung University
No.1, University Rd., Tainan City 70101, Taiwan; Tel: + 886-6-2373876#852
E-mail: honejaychu@gmail.com

[4] Associate Professor, Department of Geomatics, National Cheng Kung University
No.1, University Rd., Tainan City 70101, Taiwan; Tel: + 886-6-2373876#852
E-mail: kwchiang@mail.ncku.edu.tw

Abstract

Pedestrian Navigation with Foot- mounted sensor which is portable, small-size and low-cost is the common operation in indoor environment. The contribution in this paper is the step length estimation. The step lengths vary continuously according to the walking speed and walking frequency. In the general solution, we often setup a constant for step length and the error of step length will accumulate with the incremental step. The step length is modelled as a linear function in the regular gait in previous work, but is not applicable in the varied gait, thus we try to solve this nonlinear problem by using neural network. The exact determination of step length will represent through the neural network process and the result also display in the paper. Furthermore, the estimation of the position of a person based on inertial sensors in Pedestrian Dead-Reckoning (PDR) solution relies on heading calculation, thus, the heading drift reduction process is necessary. In this paper, we replace the compass with vision aiding, and also using other algorithms such like HDR, ZARU and ZUPT to reduce the drift in Extended Kalman Filter (EKF) framework. The vision-based method can estimate the attitude, for this reason, we could acquire the smooth result by using these algorithms which are fed into EKF without the unstable electronic compass. Finally, we display the performance including each algorithms of the reduction methods and neural network.

Key word: Pedestrian Navigation, Vision-based, EKF framework