Pre- and post-treatment methods to improve input prediction

Short version

The project will consist in exploring and evaluating software methods to improve new and existing algorithms to predict user input, for instance the finger's trajectory on a touch surface.
The candidate's task will involve, in collaboration with the involved researchers:
- implementing some of these methods (others are already implemented),
- implementing a suitable test platform to evaluate them with real users,
- designing, running, and analyzing benchmarks and controlled experiments to evaluate combinations of prediction methods in real time.
This project's findings will be submitted to a prestigious HCI journal.

Background and details

End-to-end latency in interactive systems come from many different hardware and software sources that can be incompressible—or require technological improvements not yet available. An available solution is to predict the user's input in the near future, so the system can display a feedback corresponding to the user's current location, as opposed to her last detected location. Of course, the better the prediction, the more latency can be compensated.

Such prediction methods already exist in the HCI literature, but most are limited in how far in the future they can predict–typically much less than today's end-to-end latencies. This is because, when predicting further, inaccuracies become too noticeable and cause more usability issues than the latency that these methods attempt to compensate.

The goal of this project is to explore ways to improve existing software methods of input prediction for latency compensation. It builds on a recently published research paper from the Loki and Non-A groups in Inria Lille [1], in which novel filtering and damping methods were applied to a state-of-the-art time derivative estimator (Fig. 1), allowing for significantly better and further predictions compared to precious prediction methods.

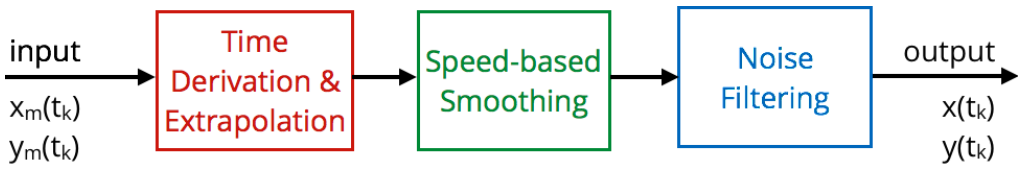

Figure 1

This project will consist in (1) investigating the individual effects of these additional steps on the quality of the predictor proposed in [1], and (2) explore how these steps can be applied to other prediction methods from the literature, in order to propose a generalized prediction framework.

The evaluation of these predictors will involve benchmarks from existing datasets of recorded motion data, as well as controlled studies in which new participants will be asked to try and evaluate the best candidate techniques.

Research and novelty

The student will have the opportunity to apply and manipulate state-of-the-art HCI techniques of latency compensation, and will actively participate in the design and running of the standard evaluation methods of the field of HCI.

If the project makes quick progress, the student will be involved in the writing of a submission to a first-class journal in HCI describing the corresponding findings.

Candidate

The candidate must demonstrate an interest in HCI, and C++ skills; previous experience in iOS is a bonus. He/she should demonstrate technical and conceptual creativity.

Context

Duration : 6 months
Lab : Inria Lille – Nord Europe, équipe Loki.
Advisors : Mathieu Nancel, Géry Casiez (prenom.nom@inria.fr)

The internship could be followed by a PhD in HCI.

[1] Nancel, M., Aranovskiy, S., Ushirobira, R., Efimov, D., Poulmane, S., Roussel, N., and Casiez, G. (2018). Next-Point Prediction for Direct Touch Using Finite-Time Derivative Estimation. In ACM CHI.