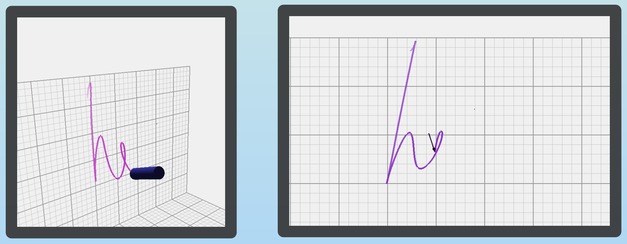
Handwriting and Gestures in the Air, Recognizing on the Fly

Sharad Vikram (sharad.vikram@berkeley.edu)
Lei Li (leili@cs.berkeley.edu)
Stuart Russell (russell@cs.berkeley.edu)

Introduction

Handwriting recognition is traditionally divided into offline and online recognition.

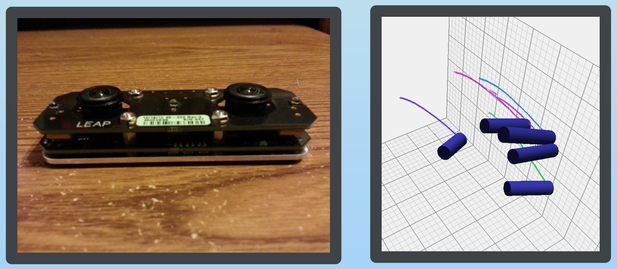


Sample input stream of points in 3D and 2D

We present the idea of doing online recognition of letters in a realtime stream of 3D finger data.

Tracking Fingers

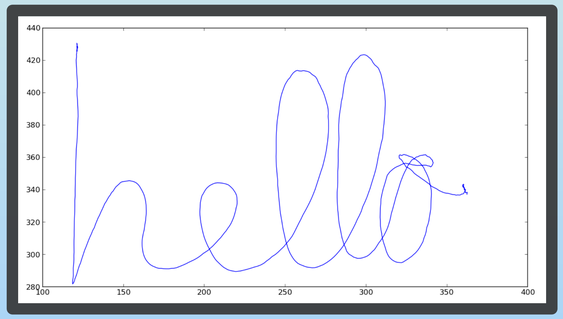
We are using the LEAP Motion, a commercial computer vision device, to obtain the data. It is a small hardware device with two cameras that tracks the precise location of fingers and other hand data.



Images of the LEAP Motion device

Experiment

We have written an application for the LEAP Motion that allows users to record their finger motions.

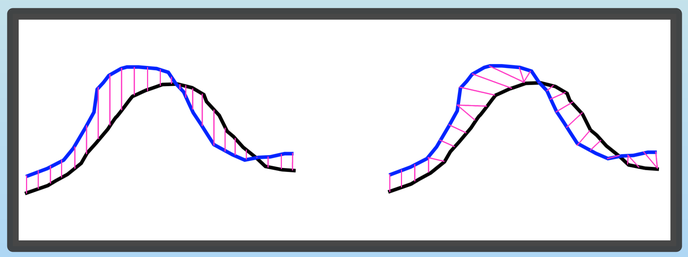


Sample input stream of points projected to 2D

The application collects recordings of letters and words in the English language from several people to train and test on.

Proposed Algorithm

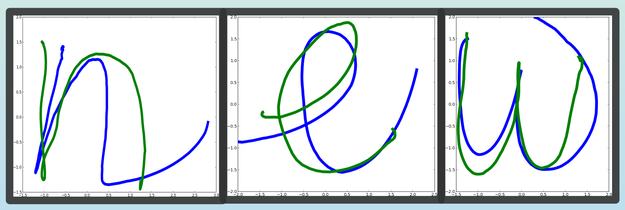
We propose to use a dynamic time warping similarity search to identify characters in sequences.



DTW is better than Euclidean distance as a similarity measure

Recent optimizations in DTW similarity search make it possible to do this process in real time.

Results



Matches of 'n,' 'e,' and 'w' using the similarity search algorithm (green is candidate, blue is match)

We ran the algorithm across several words. Its runtime was about 1 second for the word “new.”

The algorithm's speed across different databases of characters and different time warping windows was also tested.

Future Work

The LEAP Motion is a brand new input device and has a lot of potential in the field of human computer interaction.

We are pursuing a way of replacing the mouse and keyboard entirely with the LEAP motion, in addition to other functions, such as browsing the Internet and controlling media.

References:
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Plamondon, R., and Srihari, S. Online and offline handwriting recognition: a comprehensive survey.