User Identification From fNIRS Brain Data Using Deep Learning

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Highlights

This project discusses the potential of **functional near-infrared spectroscopy** (fNIRS) to identify an individual using only her brain data.

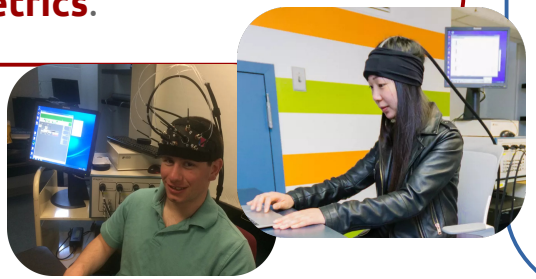
These results suggest that we can detect a specific **brain signature unique to each individual** even during resting state, which would be used in **biometrics**.

Introduction

Deep Learning has been successfully used to classify data obtained using fNIRS[1,2].

FNIRS has also been used as a **user identification and authentication tool** using SVM and Naive Bayes classifiers[3,4].

This study focuses on user identification within a larger group of **30 subjects** during **resting state**, and uses deep learning for classification.



fNIRS: a lightweight, portable, non-invasive neuroimaging tool that uses light to capture hemodynamic responses in the brain [1,2]

Results and Plan

Results:

- Maximum user identification accuracy achieved: 63%, while random chance is 3.3%
- Best results achieved for a time window of 1 seconds

Future Work:

- User classification using CNN with random kernels
- User classification using CNN with fNIRS-specific kernels
- Authentication and Privacy of brain data

	1s	3s	9s	15s	24s	30s	60s	90s
Instances /Class	1800	600	200	120	75	60	30	20
Epochs	67	200	600	1000	1600	2000	4000	6000
Accuracy	63%	61%	57%	55%	47%	51%	45%	47%
Epochs	67	200	600	1000	1600	2000	4000	6000

Table 1: Accuracy of classification over different time windows

fNIRS to detect driver's mental state

Methods

Data obtained while at rest → Raw data processed using Homer 2[5] → Features created over time window → Dataset classified using MLP

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