Machine Detection of Nystagmus from Video Recordings

Team Pink

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Introduction

- Nystagmus is an abnormal eye movement that reflects a physiologic change in neural circuitry that connects the inner ear, brain, and the eye.
- Nystagmus precedes MRI changes by 48-72 hours in stroke patients presenting with isolated dizziness or vertigo.
- Nystagmus identification and interpretation can be challenging for non-specialists.
- Nystagmus identification/interpretation is difficult via telemedicine.

Innovation & Significance

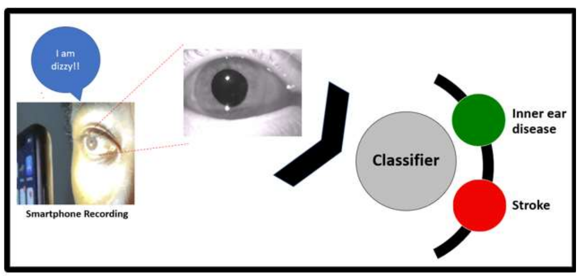


Fig1: Overview of design demonstrating a smartphone-enabled remote dizziness triage system

Methods

- We developed a deep-learning system (Fig 2) to classify 60 Hz recordings (n=435) as videos with nystagmus or video without nystagmus.
- The performance of the model (Fig 3) was calculated using the area under the receiver operating characteristic curve (abbreviated AUC) with sensitivity, specificity, negative(NPV) and positive (PPV) predictive values.

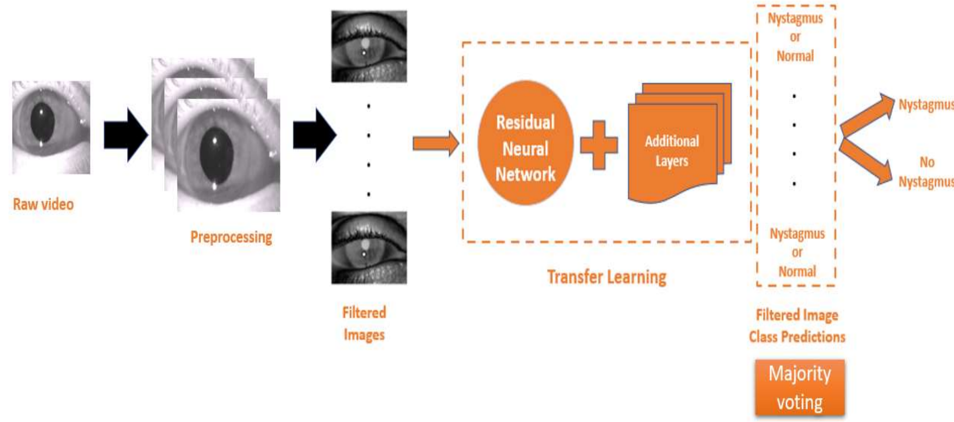
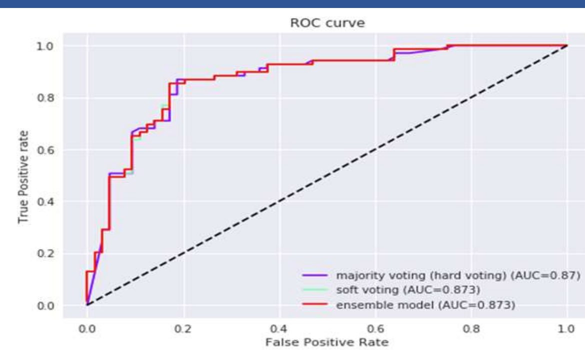


Fig 2: Overview of the deep-learning pipeline for nystagmus classifier

Results



Experiment	AUC	Sensitivity	Specificity	PPV	NPV	Accuracy
majority voting (hard voting)	0.870358	0.869565	0.812500	0.833333	0.852459	84.21%
soft voting	0.872736	0.855072	0.828125	0.842857	0.841270	84.21%
ensemble model	0.872962	0.855072	0.828125	0.842857	0.841270	84.21%

Fig 3: Summary of best performing models

Conclusions

Nystagmus can be detected from low quality videos using deep-learning methods and can be useful for remote diagnosis of dizzy patients in a pandemic, as well as becoming a permanent feature of healthcare delivery

Future Direction

1. Detection of other eye movement abnormalities
2. Home-based neurologic screening/diagnosis
3. Tele-neuroophthalmology & Tele-neurootology

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