Docket #: S18-471

A screening device system for monitoring and classifying concussions

Stanford researchers at the Camarillo Lab have designed a real-time screening device system for predicting risk of concussion resulting from head impacts. The system is comprised of a skull-mounted sensor device (instrumented mouthguard - see image below) embedded with an accompanying algorithm which uses MEMS sensors to calculate the likelihood that an impact is concussive or non-concussive using a simple mechanical model of the brain.

This algorithm includes a multi-modal (kinematics and dynamics) and multi-directional (sagittal, coronal, axial) approach to classifying brain injury. The algorithm uses a large dataset of concussions and non-concussions, and can be further refined as more data is collected.

Current approaches for sensing head kinematics do not use integrated, real-time classifiers based on the complex dynamics of the head-brain interface to predict injury risk. The combination of head motion kinematics and skull-brain dynamics weighted in the three anatomical directions is a new approach for predicting brain trauma.

This invention bridges the gap between sensor information and clinical diagnosis and may eventually be able to supplement or replace the subjective diagnostic neurological testing that is done today on the sideline by coaches and trainers.



Related Technologies from the Camarillo Lab:

Stanford Invention S13-015 - "A Novel Approach for Detecting Head Collisions in Sports"

Stanford Invention S15-432 - "Instrumented Mouthguard to Determine Accurate Head Motion During Impacts"

Stage of Research

- Developed software algorithm to classify concussions (see publication below)
- Collecting more data using instrumented mouthguard sensors to further refine this algorithm

Applications

- Screening of concussion risk in various sports and in military
- Any industry concerned with concussion prediction and prevention

Advantages

- **Real-time, rapid assessment** of concussion resulting from head impacts
- **More accurate measurement** of head injuries using large data set
- **Computational time is seconds** compared to hours in other finite element models
- **Algorithm includes a multi-modal (kinematics and dynamics) and multi-directional (sagittal, coronal, axial)** approach to classifying brain injury

Publications

- Laksari, Kaveh, Michael Fanton, Lyndia C. Wu, Taylor H. Nguyen, Mehmet Kurt, Chiara Giordano, Eoin Kelly et al. "Multi-directional dynamic model for traumatic brain injury detection." arXiv preprint arXiv:1812.07731 (2018).

Patents

- Published Application: WO2020123875

- Published Application: 20220061702
- Issued: 12,303,256 (USA)

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