Leveraging machine learning to predict and prevent poor health outcomes

Value Proposition

Problem behaviors are the leading preventable causes of death and disability in the U.S. Cigarette smoking, for instance, is responsible for over 480,000 deaths in the U.S. every year, and obesity is responsible for over 300,000. These behaviors are strongly linked to specific environments. A smoker, for example, may routinely go to their back porch or a favorite spot at a park to smoke. Furthermore, specific features in an individual's daily environments can either encourage or discourage them from engaging in a behavior. For instance, a kitchen environment stocked with junk food rather than fruit and vegetables, or with food left out in the open, may encourage overeating and discourage healthy eating.

While it is well recognized that the environment plays a strong role in literally setting the stage for unhealthy behaviors, interventions to change behavior by changing the environment (or how people interact with environments) have not been possible before now. This is because we have lacked the technology needed to identify specific environmental risk factors (e.g. smoking area) in real time and deliver environment-specific interventions to prevent (e.g. avoid this place) risk behaviors (e.g. smoking).

Technology

Duke researchers have leveraged machine learning to predict smoking and other risk behaviors in real time in response to environments and environmental features. This could be used by smokers to trigger an intervention when the technology detects a high-risk environment. For example, images from a personal, wearable camera or smart glasses can assess the environment on an ongoing basis and trigger real-time interventions. This technology can also be used to identify a wide range of risk features and make real time suggestions. For example, it can detect junk food left out on counters, identify that this feature is associated with poor eating habits, and recommend that the user modify this aspect of their environment. The approach combines a deep neural network with an interpretable classifier to effectively identify everyday objects and settings and predict their impact on behavior. The technology has been tested on mobile devices.

Other Applications

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Meet the Inventors

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Publication(s)

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External Link(s)

• From the lab of Dr. Joe McClernon
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The technology could be applied (and the team's IP covers) real-time prediction of a broad range of problem behaviors (e.g. smoking/overeating), subjective experiences (e.g. craving for a drug, anxiety, negative mood), and physiological responses (e.g. hypertension). Moreover, their IP covers alerting users to environmental risks and providing real-time, context-appropriate suggestions for avoiding risk.

Advantages

- Technology predicts smoking risk from images of everyday environments with a high degree of accuracy
- Can be applied to the prediction of a broad range of behaviors, subjective experiences, and physiological responses
- Predictions using our model are comparable to judgements made by human experts
- The technology can be run in real-time in mobile computing environments; models can be run locally with no need to send images to the cloud, thus preserving user privacy