Extended Abstract

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Computer Graphics 2017: The theory of information images: An approach to modeling the cognitive activity of the human brain - Alexandr Y Petukhov - Russia

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The presentation will present the essential principles of the knowledge Image Theory and a mathematical model developed using it. The hierarchy of data images in a private mind, which determines higher real and virtual activity, is taken into account. Algorithms for describing transfer and distortion of data images by individuals within the communication process are constructed. To corroborate the idea experimentally, the bilingual Stroop test is employed. The results of the test are interpreted using the introduced theory, and are then compared with the results of computer modeling supported the idea. It's shown that Information Images are often used not only to elucidate a variety of cognitive processes of the human mind but also to predict their dynamics during a number of particular cases. Over the past decade, functional Magnetic Resonance Imaging (fMRI) has emerged as a strong new instrument to gather vast quantities of knowledge about activity within the human brain. A typical fMRI experiment can produce a three-dimensional image associated with the human subject's brain activity every half second, at a spatial resolution of a couple of millimeters. As in other modern empirical sciences, this new instrumentation has led to a flood of the latest data, and a corresponding need for brand spanking new data analysis methods. We describe recent research applying machine learning methods to the matter of classifying the state of mind of a person's subject supported fRMI data observed over one interval. Especially, we present case studies during which we've successfully trained classifiers to differentiate cognitive states like (1) whether the human subject is watching an image or a sentence, (2) whether the topic is reading an ambiguous or non-ambiguous sentence, and (3) whether the word the topic is viewing may be a word describing food, people, buildings, etc. This learning problem provides a stimulating case study of classifier learning from extremely high dimensional (105 features), extremely sparse (tens of coaching examples), noisy data. This paper summarizes the results obtained in these three case studies, also as lessons learned about the way to successfully apply machine learning methods to coach classifiers in such settings.

Isolated, ventral brain lesions in humans occasionally produce specific impairments within the ability to use landmarks, particularly buildings, for way-finding. Using functional MRI, we tested the hypothesis that there exists a cortical area specialized for the perception of buildings. Across subjects, a neighborhood straddling the proper lingual sulcus was identified that possessed the functional correlates predicted for a specialized building area. A series of experiments discounted several alternative explanations for the behavior of this site. These results are discussed in terms of their impact upon our understanding of the functional structure of visual processing, disorders of topographical disorientation, and therefore the influence of environmental conditions upon neural organization. Although infrequently recognized intrinsically, there's neuropsychological evidence for the existence of yet one more specialized area within the extra striate cortex. This evidence is within the sort of a subset of patients that suffer from "topographical disorientation," a heterogeneous set of neuropsychological deficits that follow different, isolated brain lesions (Aguirre et al. 1998a). One sort of this disorder has been termed "landmark agnosia" (35, 18), as these patients, most typically following dextral lesions of the medial lobe, seem to possess a particular difficulty using salient environmental features for way-finding. The limited neuropsychological testing that has been performed upon these patients suggests that they're primarily impaired within the perception and recognition of street scenes, landscapes, monuments, and, most notably, buildings (15, 31, 23, 29). as long as other higher-order perceptual disorders, like general object agnosia and prosopagnosia, can occur without landmark agnosia (Tohgi et al. 1994), and as long as patients with landmark agnosia don't uniformly suffer from these more general impairments also (Hécaen et al. 1980), it's possible to argue that damage to a cortical substrate breakaway that damaged in prosopagnosia and general object agnosia is liable for this sort of topographical disorientation. Additional evidence for the separability of landmark agnosia and general object agnosia is that the compensatory strategy that landmark agnosics employ to way-find following their brain damage. Commonly, these patients report relying upon less salient environmental features (i.e., distinctive doorknobs, mailboxes, park benches) to find out and follow a path. While other explanations certainly could be offered, a facile account of landmark agnosia is that these patients have sustained damage to a cortical area that's specialized for the perception of visual stimuli with orienting value. as long as impaired recognition of buildings is usually described by landmark agnostics, and as long as buildings as a category of objects have very high landmark value (Lynch 1960), an account of such a "landmark" region would require that buildings be among the visual objects that the region is specialized. a neighborhood that's specialized for the perception of buildings could be expected to reply with the best intensity of neuronal firing to putting together stimuli, during a manner analogous thereto observed for face and word areas. Such selectivity of response should be observable using neuroimaging methods, thus offering the power to check the hypothesis of a specialized landmark area.

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