

Using Computer Vision and Machine Learning to Improve Facility Design for Healthcare Facility Worker Safety

Authors : Hengameh Hosseini

Abstract : Design of large healthcare facilities – such as hospitals, multi-service line clinics, and nursing facilities - that can accommodate patients with wide-ranging disabilities is a challenging endeavor and one that is poorly understood among healthcare facility managers, administrators, and executives. An even less-understood extension of this problem is the implications of weakly or insufficiently accommodative design of facilities for healthcare workers in physically-intensive jobs who may also suffer from a range of disabilities and who are therefore at increased risk of workplace accident and injury. Combine this reality with the vast range of facility types, ages, and designs, and the problem of universal accommodation becomes even more daunting and complex. In this study, we focus on the implication of facility design for healthcare workers suffering with low vision who also have physically active jobs. The points of difficulty are myriad and could span health service infrastructure, the equipment used in health facilities, and transport to and from appointments and other services can all pose a barrier to health care if they are inaccessible, less accessible, or even simply less comfortable for people with various disabilities. We conduct a series of surveys and interviews with employees and administrators of 7 facilities of a range of sizes and ownership models in the Northeastern United States and combine that corpus with in-facility observations and data collection to identify five major points of failure common to all the facilities that we concluded could pose safety threats to employees with vision impairments, ranging from very minor to severe. We determine that lack of design empathy is a major commonality among facility management and ownership. We subsequently propose three methods for remedying this lack of empathy-informed design, to remedy the dangers posed to employees: the use of an existing open-sourced Augmented Reality application to simulate the low-vision experience for designers and managers; the use of a machine learning model we develop to automatically infer facility shortcomings from large datasets of recorded patient and employee reviews and feedback; and the use of a computer vision model fine tuned on images of each facility to infer and predict facility features, locations, and workflows, that could again pose meaningful dangers to visually impaired employees of each facility. After conducting a series of real-world comparative experiments with each of these approaches, we conclude that each of these are viable solutions under particular sets of conditions, and finally characterize the range of facility types, workforce composition profiles, and work conditions under which each of these methods would be most apt and successful.

Keywords : artificial intelligence, healthcare workers, facility design, disability, visually impaired, workplace safety

Conference Title : ICOHR 2023 : International Conference on Occupational Health Research

Conference Location : London, United Kingdom

Conference Dates : June 22-23, 2023