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Deep Learning for Universal Mapping of Odors from Different Cancers

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In

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ABSTRACT

Cancer is a generic term for a large group of diseases that can affect any part of the body. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs, the latter process is referred to as metastasizing. Metastases are a major cause of death from cancer. Cancer is the second leading cause of death globally, and is responsible for an estimated 9.6 million deaths in 2018. Globally, about 1 in 6 deaths is due to cancer. Approximately 70% of deaths from cancer occur in low- and middle-income countries. Deep learning is a recent and fast-growing field of machine, learning. It attempts to model abstraction from large-scale data, by employing multi-layered deep neural networks (DNNs), thus making sense of data such as images, sounds, and texts.

Deep learning in general has two properties: (1) multiple layers of nonlinear processing units, and (2) supervised or unsupervised learning of feature presentations on each layer. The early framework for deep learning was built on artificial neural networks (ANNs) in the 1980s, while the real impact of deep learning became apparent in 2006. Since then, deep learning has been applied to a wide range of fields, including automatic speech recognition, image recognition, natural language processing, drug discovery, and bioinformatics. With the aim to design a deep learning classifier for the identification of various types of cancer (lung cancer, breast cancer and brain cancer, based on odors of 386 patients diagnosed with cancer and 212 healthy controls samples with no underlying diseases matched for sex, and the socioeconomic level. These samples of different biological fluids (in case of lung cancer (LC). Tissue biopsy was taken from suspicious lung mass for histopathological evaluation and blood, urine, breath and tissue biopsy if present) were collected and processed using E-Nose. Odor-print patterns were further analyzed using the principal component analysis (PCA) and ANN analysis. Moreover, ANN technique can differentially diagnosis three types of cancer (lung, breast, and brain)in case of using blood, urine and biopsy samples with accuracy 91, 98, and 95 %, respectively.