

Topic: How machine learning models (CNN&CF) are used for mental health tasks like diagnosing and recommended treatment plans?

Two tentative models for using in this project:

- CNN (Detection)
- CF (Therapy plan selection)

Literature Review

1. Convolutional neural network

An overview of past work that uses the same methods (machine learning model) to address similar (but not exactly the same) problem(s).

Deep learning has started to have a strong connection with mental health ; therefore, artificial intelligence (AI) methods have been introduced to assist mental health providers, including psychiatrists and psychologists, for decision-making based on patients' historical data.

According to (Su, Xu, Pathak, et al, 2020) CNN can have a promising outcome from processing clinical images and expression data such as facial expression images to detect mental health conditions. CNN will be mainly used to identify local spatial patterns; different illness will have their own special patterns for example different patterns were discovered between ADHDs and controls in the prefrontal cortex and cingulate cortex, and schizophrenia where DFNN, DBN, and autoencoder were utilized (Su, Xu, Pathak, et al, 2020). (Geng et al, 2017) proposed to use CNN and autoencoder to acquire meaningful features from the original time series of fMRI data for predicting depression. Both of the studies proposed the idea that using images can help to investigate the symptoms and proposed a solution for future appointments. In their research they developed a CNN and used the convolution mechanism to capture correlations of the neighboring loci within the chromosome. Moreover, they combine CNN architecture pre-trained over 1.28 million general images and fine-tuned in the clinical image dataset and pre-trained CNN on the public face recognition dataset to model the static facial appearance, which overcomes the issue that there is no facial expression label information.

2. Collaborative Filtering

An overview of past work that uses the same methods (machine learning model) to address similar (but not exactly the same) problem(s).

Researchers are working on using machine learning and recommendation systems to make healthcare more personal. Some studies focus on general health, while others concentrate on mental health, but they often use similar methods. For instance, Hussain et al. (2023) developed a system that combines deep learning and collaborative filtering. They utilized a specific tool which is a combination of Restricted Boltzmann Machine (RBM) and Convolutional Neural Network (CNN) model to find patterns in patient information and suggest the best healthcare services. This approach made their system more accurate than older models. Although their research was about general healthcare, the same technique could also benefit mental health care. In another study, Arora, Kush, and Choudhary (2023) created a hybrid recommendation system that provides personalized mental health recommendations, such as therapy options and self-help programs. They mixed different methods and user feedback to improve their suggestions. While their study focused specifically on mental health, it shared ideas with Hussain et al. (2023). Both studies illustrate that using a combination of advanced technology can help make healthcare and mental health support more personal and effective.

Bibliography:

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P. Chinnasamy et al., "Health Recommendation System Using Deep Learning-based Collaborative Filtering," *Helion* 9, no. 12 (November 24, 2023): e22844, <https://doi.org/10.1016/j.heliyon.2023.e22844>.

Su, Chengcheng, Zhiguo Xu, Jyotishman Pathak, et al. "Deep Learning in Mental Health Outcome Research: A Scoping Review." *Translational Psychiatry* 10, no. 116 (2020). <https://doi.org/10.1038/s41398-020-0780-3>.

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Link for Github Repository: <https://github.com/WanrouYang/DS4420-Group-Project>