Sanjivani Rural Education Society's

SANJIVANI COLLEGE OF ENGINEERING,

KOPARGAON 423 603 (MS)

(An Autonomous Institute)

Department of

Computer Engineering (2024-2025)

SEMINAR AND COMMUNICATION SKILLS

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TOPIC: PNEUMONIA DETECTION USING CNN BASED FEATURE EXTRACTION

Assignment 1:

Identify application as social problem using algorithmic methodologies.

Social problem :

Pneumonia and lung cancer are among the leading causes of death globally, particularly in underdeveloped and resource-constrained regions. Both diseases pose significant public health challenges due to delayed or missed diagnoses, which result from a reliance on human interpretation of medical imaging (such as X-rays and CT scans). This reliance on expert radiologists, who are often scarce in rural or economically disadvantaged areas, leads to increased mortality rates as early detection and treatment are critical for survival.

Key Challenges:

- Limited Access to Medical Expertise: In many low-income regions, access to expert radiologists who can accurately diagnose conditions like pneumonia or lung cancer from medical images is limited, causing delays in treatment.
- Diagnostic Complexity: The symptoms of pneumonia and early-stage lung cancer can be subtle and are often missed in medical imaging, even by trained professionals. This complexity exacerbates diagnostic inaccuracies.
- High Mortality Rates: Due to delayed diagnosis, both diseases are often detected at advanced stages, leading to higher mortality rates, particularly among vulnerable populations such as children, the elderly, and those with compromised immune systems.
- Inequality in Healthcare: People in underdeveloped regions are disproportionately affected due to the lack of affordable and accessible diagnostic tools and healthcare facilities.

To identify social problems using algorithmic methodologies, such as pneumonia detection from chest X-rays, several techniques can be adapted to broader applications for addressing societal challenges. Here's how **Algorithmic Methodologies** can be applied:

1. **Problem Identification & Data Collection:**
    - Social problems like poverty, healthcare inequity, or environmental pollution often arise from complex, multifactorial causes. Similar to detecting pneumonia in chest X-rays, AI models can analyze large datasets (such as public health records, pollution levels, or economic data) to identify patterns of inequality or systemic issues.
    - For example, the pneumonia detection models discussed in the provided papers utilize CNNs and deep learning to analyze medical images(Pneumonia_Detection_Usi…)(1-s2.0-S020852162200074…)(PY057). This methodology can be extended to analyze other types of data like socioeconomic factors or satellite images to identify areas of social vulnerability, such as regions more likely to experience poverty or inadequate healthcare access.
2. **Algorithm Design:**
    - In both medical imaging and social problem detection, algorithmic models such as deep learning (CNNs, RNNs), random forest, or support vector machines (SVMs) can be applied. For example, CNNs have been highly effective in pneumonia detection from X-rays (PY057).
    - These models can be adapted to process and analyze various social datasets. For instance, transfer learning—pretrained models like ResNet or VGGNet—could be used to detect patterns in satellite images related to environmental degradation or urban poverty.
3. **Predictive Analytics:**
    - Algorithmic methods can be used to predict future outcomes based on historical data. Just as pneumonia detection models predict the presence of disease in X-rays(Pneumonia_Detection_Usi…)(1-s2.0-S020852162200074…)(PY057), similar methods can forecast social issues like unemployment spikes or areas of potential environmental disaster based on historical trends.

- A hybrid model such as DNN with AdaBoost used in pneumonia detection can be applied to social problems to improve the prediction accuracy(PY057). For example, analyzing the risk of homelessness by identifying key factors (income levels, rent prices, etc.) from large datasets.

4. **Image Analysis and Computer Vision:**
    - Techniques used to detect subtle features in X-ray images (e.g., convolutional layers identifying pneumonia) can also be used to analyze visual data for social good. For instance, analyzing satellite images to detect deforestation, urban expansion, or illegal mining.
    - Algorithms similar to CNNs used for pneumonia detection (Pneumonia_Detection_Usi…)(PY057) could analyze images to track pollution levels or monitor natural disaster damage.
5. **Ethical AI and Fairness:**
    - When addressing social problems, it is crucial to ensure the algorithms are designed ethically, considering biases in the data. Algorithmic decisions must ensure fairness across different demographic groups, similar to ensuring that medical AI doesn't perform differently across populations (e.g., racial bias in healthcare).

By adapting these advanced algorithmic methodologies from fields like medical imaging to solve social problems, AI can offer powerful tools for early detection, prediction, and intervention in social issues, improving decision-making and resource allocation in areas such as healthcare, poverty alleviation, and environmental conservation.