Poster: PressureSilhouette: A Model to Predict Sleep Silhouette from Pressure Mattress Images

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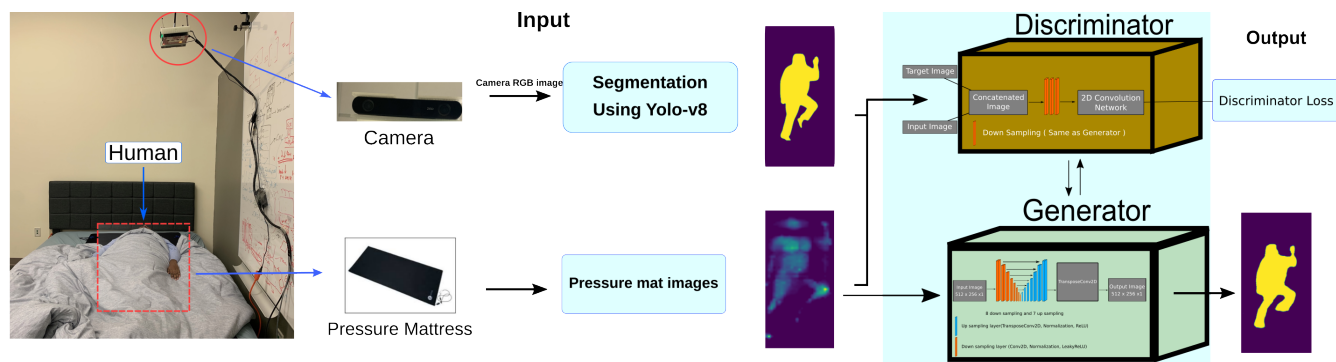Computer Science and Engineering; University of South Carolina, Columbia, USA

Figure 1: Overall setup architecture demonstrating data collection, preprocessing, and model architecture.

ABSTRACT

Sleep monitoring has many health applications. One of the main tasks in sleep monitoring is sleep posture classification. Most of the traditional approaches have a camera as their primary detector which can be privacy-invasive and malfunction in some settings. An alternative is to use pressure mats. The problem however with most of the pressure mat raw images is that they contain gaps and discontinuous blocks which makes direct classification challenging. To address this issue, we propose *PressureSilhouette*, a deep learning model based on the Pix2Pix model that predicts the silhouette of the body. Using the generated silhouette, we will be able to predict the posture classification more accurately.

CCS CONCEPTS

• **Human-centered computing** → **Ubiquitous and mobile computing systems and tools**; • **Computing methodologies** → **Machine learning approaches**.

KEYWORDS

Sleep Posture Monitoring; Pressure Mattress

SYSTEM DESIGN

To prepare our data for model training, we collected 200 sync pressure mat and RGB images from a single volunteer in 14 postures.

In order to extract the silhouette from the RGB images, we utilized the *YOLO-v8* model[1] to predict the bounding box and locate the person's silhouette within that box. Once the silhouette was obtained, we positioned the bounding box (with the silhouette inside) at the center of a blank 512×256 box. We took this step to prevent any potential changes in body composition caused by resizing the initial bounding box.

After preprocessing, we customized the Pix2Pix[2] model and trained it to predict the silhouette from a pressure mat image input.

PRELIMINARY RESULTS AND FUTURE WORK

From the total of 200 images for each of our postures, we used 150 images for training and the remaining 50 images to test our model. The metric that we used was IoU (Intersection of Union) between the silhouette of ground truth and generated silhouette images. We used the total number of 700 (50×14) images to calculate the mean and CDF of our metric. Our model achieved an overall mean of 77%. It also had 50th percentile of 75.9% and 90th of 85%.

We proposed a Pix2Pix model and predicted silhouette using pressure mat images as our input. However, the ultimate goal is to classify sleeping postures from pressure mat images. To achieve this goal in our future work, we will train a new classification model to receive the generated pressure mat silhouette as its input and directly predict the sleeping pose.

ACKNOWLEDGEMENT

REFERENCES

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