1. **Computer Vision-Based Human Body Posture Correction System:**

The paper presents a methodology to detect and correct poor sitting postures using computer vision and deep learning techniques. Here’s an overview of the methodology, along with its pros and cons:

**Methodology**

1. **System Architecture and Hardware Design:**
   * Utilizes Raspberry Pi 4B and Raspberry Pi Camera Module V2.
   * OpenCV for visual processing and YOLOv8 for object recognition and keypoint detection.
   * Incorporates an SVM classifier for posture judgment.
   * Provides real-time feedback through alarms and voice prompts.
2. **Program and Algorithm Design:**
   * **Key-point Detection and Localization:**
     + YOLOv8n model used for detecting key points (eyes, nose, ears, shoulders).
     + CSPDarknet53 for feature extraction.
     + PAN (Path Aggregation Network) structure for feature fusion.
   * **Pose Analysis and Classification:**
     + Calculation of distances between key points (e.g., ears to shoulders).
     + Features f1f1f1 and f2f2f2 derived from these distances to determine posture.
     + SVM classifier used to classify posture as "good" or "bad".
   * **Error Threshold Analysis:**
     + Considers physiological differences, environmental factors, and minor postural adjustments to set error thresholds.
   * **Support Vector Machine (SVM) Classification:**
     + Gaussian kernel used for SVM to handle non-linearity and high-dimensional pattern recognition.
     + Grid search method to optimize penalty parameter CCC and kernel parameter σ2\sigma^2σ2.

**Pros**

1. **High Accuracy:** The system achieves an average recognition rate of 95%, indicating reliable posture detection.
2. **Real-time Performance:** The system provides immediate feedback to the user, helping to correct posture promptly.
3. **Compact and Portable:** The hardware setup is compact, supporting both Windows and Linux operating systems.
4. **Practical Implementation:** Successfully deployed on Raspberry Pi, demonstrating good practicality and stability.
5. **Versatile Design:** Can detect various postures and remind users to correct poor posture or take breaks from prolonged sitting.

**Cons**

1. **Hardware Limitations:** Using Raspberry Pi might limit processing power, which could affect performance in more complex or resource-intensive tasks.
2. **Environmental Dependence:** Accuracy might vary depending on environmental conditions such as lighting, camera angle, and user distance from the camera.
3. **Physiological Variability:** Individual differences in body structure might affect the system's ability to uniformly detect and correct posture across different users.
4. **Error Threshold Sensitivity:** Setting appropriate error thresholds is challenging due to the variability in user posture and environment, potentially leading to false positives or negatives.
5. **Limited Scalability:** The system is designed for individual use and might need significant modifications for larger-scale applications or different settings.

Overall, the paper demonstrates a robust approach to posture correction using computer vision and machine learning, with practical implementation and real-time feedback capabilities. However, certain limitations related to hardware, environmental conditions, and individual physiological differences need to be addressed for broader applicability.

**2. A Deep-Learning Based Posture Detection System for Preventing Telework-Related Musculoskeletal Disorders:**

This paper proposes a system to detect and correct poor posture in teleworkers. The system utilizes a convolutional neural network (CNN) to process video in real-time, detecting the posture of the neck, shoulders, and arms, and providing recommendations to improve posture.

**Key Components:**

1. **Hardware Setup**:
   * The system includes a camera (such as a webcam) positioned to capture the user from head to arms.
   * The video from the camera is processed using an embedded system that runs the CNN for posture detection.
2. **Software Setup**:
   * The neural network used is a pose estimation model called TRT\_Pose, designed to run on NVIDIA devices (e.g., NVIDIA Jetson family).
   * The neural network is pre-trained using the MSCOCO dataset, which includes diverse images of people.
3. **Posture Detection and Recommendations**:
   * The system estimates the position of key joints (neck, shoulders, arms) and calculates angles to assess posture.
   * Recommendations are provided based on ergonomic guidelines to maintain correct posture and avoid musculoskeletal issues.
   * The system runs in real-time, providing feedback at up to 25 frames per second with low power consumption.
4. **Evaluation**:
   * Various NVIDIA hardware platforms are evaluated for their performance in terms of execution time, power consumption, and efficiency.
   * The study compares the hardware platforms to determine the most effective one for real-time posture detection.

**Pros**

1. **Real-Time Processing**:
   * The system processes video in real-time, providing immediate feedback to users to correct their posture.
2. **Low Power Consumption**:
   * The specialized hardware used in the system ensures low power consumption, making it suitable for continuous use.
3. **High Accuracy**:
   * The system achieves over 80% accuracy in detecting posture, making it reliable for practical use.
4. **Embedded System Integration**:
   * The use of embedded systems (like NVIDIA Jetson) allows for a compact and efficient solution that can be integrated into various environments, such as on top of computer screens.
5. **Comprehensive Evaluation**:
   * The study thoroughly evaluates different hardware options, ensuring the system's effectiveness and efficiency.

**Cons**

1. **Hardware Dependency**:
   * The system relies on specific hardware (NVIDIA devices), which may limit its accessibility and increase costs for some users.
2. **Pre-Trained Model Limitations**:
   * While the pre-trained model on the MSCOCO dataset is diverse, it may still have limitations in accurately detecting posture in all real-world scenarios or with all body types and clothing styles.
3. **Initial Setup Complexity**:
   * Setting up the system may require technical knowledge, particularly in configuring and integrating the embedded systems and neural networks.
4. **Limited Scope of Detection**:
   * The system focuses on the neck, shoulders, and arms, which means it may not detect poor posture involving other body parts like the lower back or legs.

Overall, the methodology presented in this paper demonstrates a practical and effective approach to addressing telework-related musculoskeletal disorders through real-time posture detection and correction. However, its dependency on specific hardware and potential limitations in detection scope should be considered when evaluating its overall utility and applicability.