RoboFriend – Rock-Paper-Scissors Robot

This repo contains an end-to-end Rock-Paper-Scissors (RPS) demo that combines **computer-vision hand-gesture recognition**, an **Allegro robotic hand** in PyBullet, and a **Tk / ttkbootstrap** launcher GUI.

▶️ Quick Start

```
# 1  clone / copy the files and cd into the folder
python -m venv tfenv     # create a virtual-env (optional but recommended)
# Windows
./tfenv/Scripts/activate
# Linux / macOS
source tfenv/bin/activate

# 2  install all required packages
pip install --upgrade pip
pip install joblib scikit-learn mediapipe opencv-python \
      ttkbootstrap pybullet numpy robot_descriptions

# 3  run the game
python rps_vision_robot.py
```

Files & Folders

Path	Purpose
`rps_vision_robot.py`	**Main script** – launches GUI, camera, and robot thread
`rps_landmarks.joblib`	Trained sklearn classifier on MediaPipe hand landmarks
`label_map.txt`	Labels in model order (`rock` , `paper` , `scissors`)
`icons/`	RGBA PNG icons (`rock.png` , `paper.png` , `scissors.png`) displayed in OpenCV window
`README.md`	This document

♒ Dependencies

- **Python 3.9 – 3.12**
- `mediapipe` 0.10+
- `opencv-python` 4.7+
- `ttkbootstrap` 1.10+
- `pybullet` 3.2+
- `robot_descriptions` (fetches Allegro-hand URDF automatically)
- `scikit-learn` , `joblib` , `numpy`

GPU note: TensorFlow warnings about oneDNN are harmless – ignore or set `TF_CPP_MIN_LOG_LEVEL=2`.

🚶How to Play

1. Choose **best-of** rounds (3, 5, 10) in the launcher and click **Start Game**.
2. A camera window opens. Press **Space** to start each round.
3. Show a hand gesture inside the webcam view before the countdown reaches 0.
4. The bot chooses randomly; the Allegro hand performs the bot's move in a separate PyBullet window.
5. Scoreboard updates automatically. Press **Esc** to quit at any time.

🔯Customization

- **Model retrain:** collect new landmarks, train an `sklearn` classifier, dump to `rps_landmarks.joblib`.
- **Hand poses:** edit `setup_allegro_hand()` → `scissors()` to tweak MCP/PIP/DIP angles.
- **Icons / GUI theme:** replace PNGs in `icons/` or change ttkbootstrap theme (e.g. `flatly`, `darkly`).

Credits

- MediaPipe Hands team – landmark detection
- Allegro Hand URDF courtesy of **robot_descriptions** project
- Original inspiration: OpenAI ChatGPT session with Noam, June 2025

Enjoy your robo-powered RPS!\ – ChatGPT (OpenAI o3)