Assignment: Player Re-Identification in Sports Footage

Option 2: Re-Identification in a Single Feed

Objective:
Given a 15-second video (15sec_input_720p.mp4), identify each player and ensure that players who go out of frame and reappear are assigned the same identity as before.

Approach and Methodology:

The system detects and re-identifies players in a 15-second soccer video using YOLOv11 for object detection and a ResNet18-based tracker for appearance-based re-identification. It outputs an annotated video and evaluation metrics.

- **Detection**: YOLOv11 is used with custom thresholds for each class to improve player detection reliability.
- **Tracking**: An EnhancedTracker uses appearance, spatial, and size similarity with ResNet18 embeddings.
- **Visualization**: Bounding boxes with consistent colors and IDs are drawn per object class.
- **Evaluation**: A script analyzes logs to compute detection accuracy, ID switches, and re-identification success.

Techniques Tried and Outcomes:

- **Initial Detection**: conf_thres=0.4 yielded no detections. Lowering to 0.25 with class-specific values improved player visibility.
- **Re-ID Optimization**: Lowered similarity threshold and improved player tracking, achieving 96.27% re-ID accuracy.
- **Embedding ResNet18 for Ball**: Tried using lightweight 64×64 embeddings. Partial success but low re-ID for small objects.
- **Evaluation Fixes**: Fixed log parsing to get accurate metrics and approximate FPS (63.87, possibly inflated).

Challenges Encountered:

- **Player Occlusion**: Reduced detection count (~12.77 vs. 16 expected).
- **Ball and Goalkeeper Confusion**: Low detection and re-ID rates due to small size and visual similarity.
- **ID Switches**: High number of switches caused by inconsistent detections.
- **FPS Accuracy**: FPS estimation inflated due to log-based timing.
- **Time Constraints**: Limited time prevented model fine-tuning or predictive tracking (e.g., Kalman filters).

Future Work:

- Fine-tune YOLOv11 on a soccer-specific dataset for better player and goalkeeper detection.
- Add Kalman filters for better ball tracking and reduce ID switches.
- Replace ResNet18 with MobileNet for faster embedding generation.
- Improve FPS measurement using actual frame timestamps.
- Enhance visualization and debugging tools for missed detections and re-ID failures.

Conclusion:
Despite challenges with secondary classes (ball, goalkeeper), the system achieved 96.27% accuracy in player re-identification — successfully fulfilling the assignment's primary objective.