

## ABSTRAK

Penelitian ini mengembangkan sistem analisis kecepatan pemain sepak bola berbasis *computer vision* menggunakan YOLOv8 untuk deteksi objek, *DeepSORT* untuk pelacakan multi-objek, dan K-Means *clustering* untuk identifikasi tim berdasarkan warna *jersey* pada ruang warna HSV. Sistem memproses video rekaman pertandingan melalui tahap *preprocessing* (*resizing*, konversi ruang warna, dan *filtering*), kompensasi pergerakan kamera dengan Lucas-Kanade *Optical Flow*, serta perhitungan kecepatan dengan mekanisme *filtering* dan *smoothing*. Pengujian pada tiga video durasi 30 detik menunjukkan bahwa K-Means *clustering* berbasis *hue* HSV efektif mengelompokkan pemain dengan nilai *Silhouette Score* 0,61–0,73 dan jarak antar *centroid* terkecil  $6,33^\circ$  pada warna *jersey* yang sangat mirip. Estimasi kecepatan berdasarkan 22 sampel terbaik (11 pemain per tim) menghasilkan rata-rata kecepatan gabungan 26,64 km/jam, 30,74 km/jam dan 29,88 km/jam, dengan deviasi terhadap referensi *high-speed running* profesional (23 km/jam) sebesar +15,83%, +33,65%, dan +29,91%. Kecepatan maksimum realistis yang terekam adalah 36,2 km/jam, yang selaras dengan literatur *sprint* atlet elit (~38 km/jam). Perbandingan ruang warna membuktikan HSV lebih robust terhadap perubahan cahaya dibandingkan RGB yang nilai komponennya berubah hingga 22 poin. Sistem diimplementasikan dalam aplikasi web berbasis *Flask* yang memungkinkan *upload* video, analisis otomatis, dan unduh hasil anotasi (*bounding box*, ID pemain, kecepatan instan). Dengan demikian, sistem layak digunakan sebagai alat bantu analisis performa pemain secara objektif dan terukur.

**Kata Kunci:** YOLOv8, DeepSORT, K-Means *Clustering*, Kecepatan Pemain, Sepak Bola

## ***ABSTRACT***

*This research develops a computer vision-based football player speed analysis system using YOLOv8 for object detection, DeepSORT for multi-object tracking, and K-Means clustering for team identification based on jersey color in the HSV color space. The system processes match videos through preprocessing (resizing, color space conversion, and filtering), camera motion compensation using Lucas-Kanade Optical Flow, and speed calculation with filtering and smoothing mechanisms. Testing on three 30-second videos demonstrates that HSV-based K-Means clustering effectively distinguishes teams, achieving Silhouette Scores between 0.61 and 0.73, with the closest centroid distance of 6.33° for highly similar jersey colors. Speed estimation based on the 22 best samples (11 players per team) yielded average combined speeds of 26.64 km/h, 30.74 km/h, and 29.88 km/h, with deviations against the professional high-speed running reference (23 km/h) of +15.83%, +33.65%, and +29.91%. The maximum realistic speed recorded is 36.2 km/h, which aligns with elite sprint literature (~38 km/h). Comparative analysis proves that HSV is more robust to lighting changes compared to RGB, which fluctuates up to 22 points. The system is implemented as a Flask-based web application enabling video upload, automated analysis, and annotated video download. Therefore, the system is feasible as an objective and measurable tool for player performance analysis.*

**Keywords:** YOLOv8, DeepSORT, K-Means Clustering, Player Speed, Soccer