1RT001 Assignment 2: Using tracking data

We have assessed three home matches of tracking data for Hammarby, delivered by Signality who use AI to automatically track the positions of all players from video footage. The positional data is mostly fine in open play, however, in crowded situations like set pieces, the AI struggles to identify the correct players. The AI also struggles to identify the ball position properly even in open play to such a degree that interpolation leads to confusing effects.

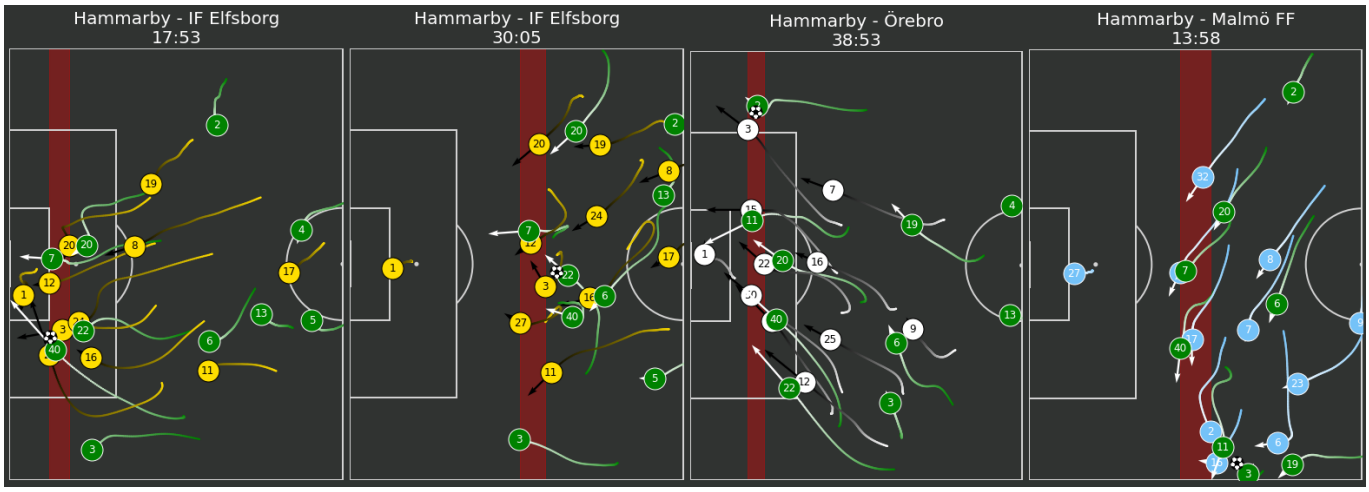

Figure 1: Four freeze-frames from three different matches, all just before Hammarby (green) scores. Arrows indicate player velocity; tails indicate movement last five seconds. Red area indicate space where attacking players are onside due to defensive misalignment of the opposition back four.

We derived information about player velocity and acceleration by looking at the first and second time derivates of the positions. Four freeze frame examples from the matches are provided in Figure 1. Note that due to inherent noise in the data, velocities were smoothed using a moving averaging window of 7 samples before calculating the speed from the velocities. The acceleration was calculated from the speed, and then smoothed with the same 7 sample moving average window. Care must be taken before accepting information at face value, especially for the higher order derivates. While pre-processing like smoothing is required, robust assessment is complicated by the fact that different vendors apply different pre-processing. Access to the raw data or at least knowledge of how pre-processing is performed is thus vital for more complex calculations needed for assessment of actual physical load. With a grip on the uncertainty in the data and player weight it is possible to get an overview of physical load due to sprints and accelerations/decelerations. It would be interesting to study if anything can be inferred from the jerk, especially related to decelerations, which can pose a significant physical load than even at low speeds. Measuring relative load against opponents within the same match to see how and where the most intensive running is done (see Figure 2) should however be fine as the uncertainty should even out. With possession and possession loss information we should be able to derive metrics around pressure and counterpressure from the data set as well.

Results from four 15 second intervals including the freeze frames in Figure 1 is shown in Figure 3, along with distance from goal. We look at the front four only, with average position for the opposition back four is provided for reference. Note that even after smoothing, we observe obvious errors for Rodic in the match against Örebro. For all attacks we observe some correlation between the attacking runs, and regions of elevated speed and acceleration likely related to runs behind the opposition defenders. We also see that one or two Hammarby players are closer to goal than the opposition back four, indicating misalignment and space to run in. While some information can be read from these figures, and there's potential for using signal analysis and machine learning to pick up coherent play phases, actual positions on the pitch are needed to assess if we are looking at defense-splitting runs and/or decoy runs.

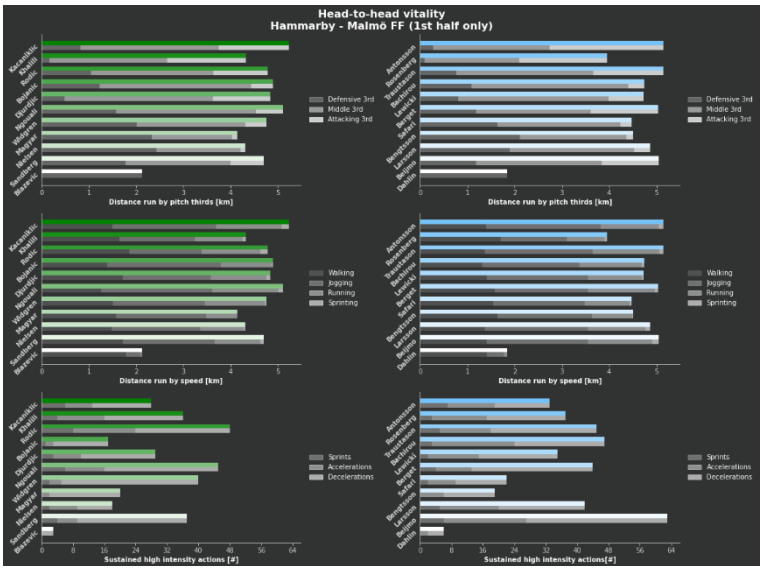

Figure 2: Head-to-head vitality data for the 1st half of Hammarby - Malmö FF

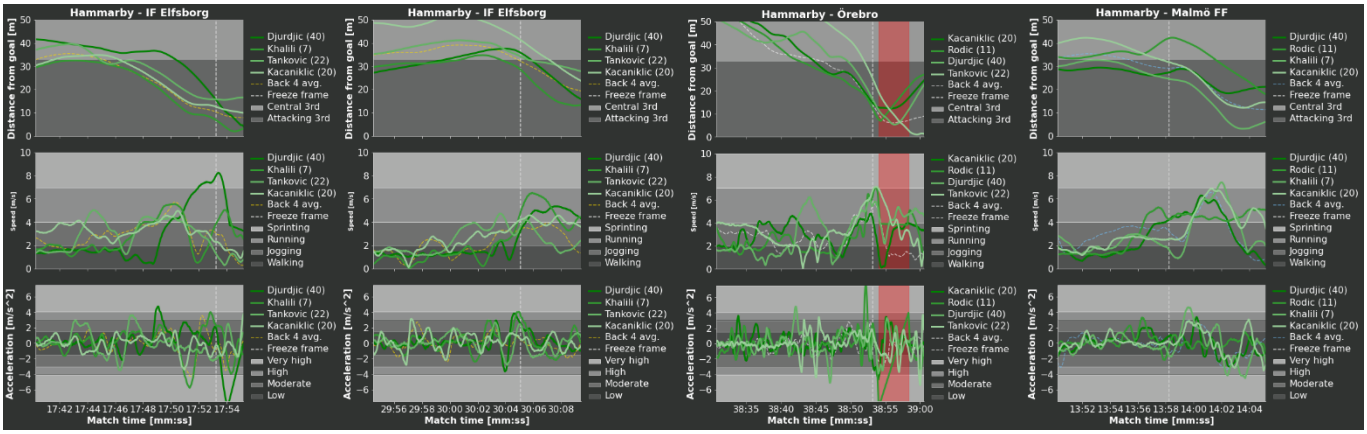

Figure 3: Vitality data for Hammarby's front four (strikes and wingers) corresponding to the freeze frames in Figure 1. Average data for opposition back four is plotted for comparison. Freeze frames times are indicated by the vertical bars. Pitch zones and load intensity are indicated by background shading. Even after smoothing, errors in speed and acceleration data are identified for Rodic in the Örebro match (red shade).

Looking closer at the second situation from Hammarby – Elfsborg in Figure 3, we see that Khalili is closer to the goal than the opposition back four, indicating that he's moving in an area where he's played onside by their misalignment. This could possibly be due to the defenders being dragged out of position by runs from Djurdic and/or Tankovic. Kacaniklic seems to arrive late in the box from a deep run from midfield.

In Figure 4 we focus on Khalili's run in this situation, displaying the distance to the closest opposition player and teammate. The closest positions are easily found using a *k*-d-tree implementation. We have also included information about Khalili's speed and acceleration in this plot to see if they correlate to the movements around him. At the time where the closest opposition player switches from Gregersen to Portillo (1), we see that Khalili slows down while the distance to Portillo decreases, before the distance increases again following a burst of acceleration. Slightly delayed but following the same pattern we see the closest teammate switches from Bojanic to Tankovic (2), with Tankovic getting closer to Khalili until he passes to him at (3) and drifts away again.

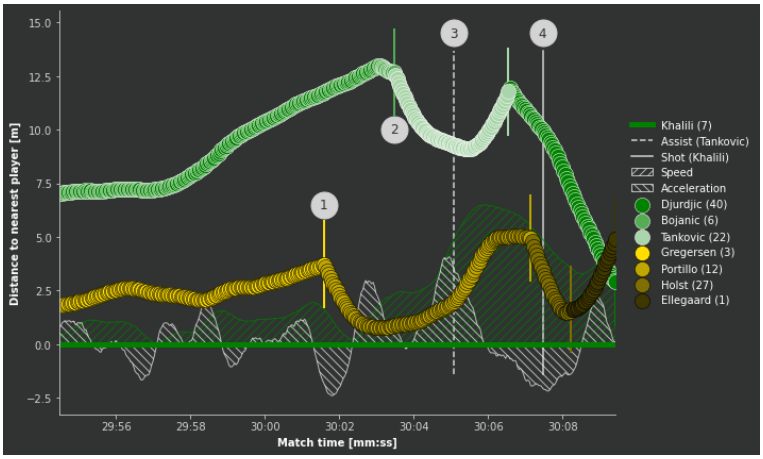

Figure 4: Distance to closest opposition player and teammate for Khalili during the run-up to the 3-0 goal against IF Elfsborg. Vertical bars emphasize change in nearest player, numbers indicate times of freeze frames in Figure 4. Shaded green area shows Khalili's speed in m/s, while shaded white area show his acceleration in m/s^2.

We then introduce pitch control (as implemented by Spearman) and investigate the four key moments from Figure 4 in Figure 5. We see in frame 1 that Khalili is heading in the opposite direction of Portillo, sneaking in behind his back while both Portillo and Gregersen are dragged wide by Bojanic's ball carrying as well as the runs made by Djurdic and Tankovic in frame 2. When Tankovic receives the pass from Bojanic in frame 3, he is completely in control of his surrounding space and free to make an incisive pass (red line) behind Elfsborg's defensive line in the space between Gregersen and Portillo into Khalili's decisive run. Khalili finishes in style in frame 4, chipping the ball over the goalkeeper.

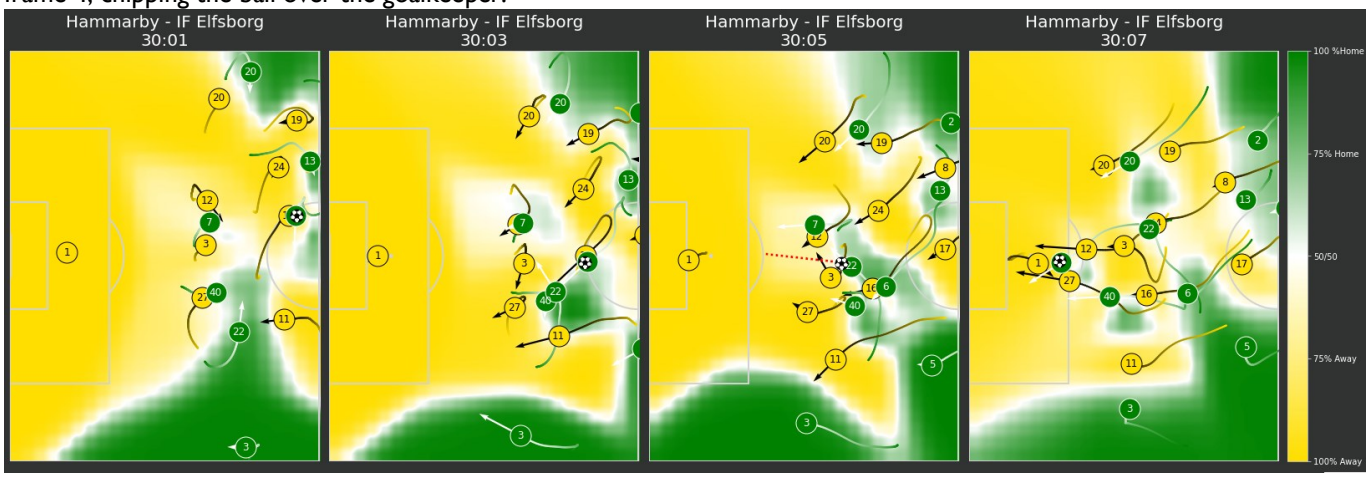

Figure 5: Freeze frames with pitch control vital moments in the run-up before the 3-0 goal for Hammarby vs IF Elfsborg. corresponding to the four markers in Figure 4. As in Figure 1, arrows indicate player velocity and tails movement for the last 5 seconds. Colors indicate probability of possession in an area.