Inverse Kinematics

We somehow simplify the problem of IK in order to find a good answer between
the answers. at first we made a link between the first joint rotation and the
Agents real rotation around the Z-axis, so with knowing the proper rotation
around the Z-axis we know the first joint angle. Then with the forward kinematic
and some triangular equations we find other joint angles in order to move the
ankle to the desired position with the desired rotation. Although the methods
which are using derivations and jacobian matrices iteratively may result in more
accurate answers, time complexity of this algorithm is very efficient, so we will
have more time for more complex computations in other parts, like predicting
next cycles in decision making part. Our next goal is to find a method using
jacobian matrixes and this method in the same time, to be able to find answers
in all the possible positions.

PSO

we use particle swarm optimization method in most of our basic actions to
improve their stability and speed.

World Model

Localization: we are able to localize with any number of flags that we have seen
or field lines. we calculate body and neck rotation matrices with GYR, then
with inverse matrix rotation, we are able to undo the influence of body and neck
rotation on the distance and angle of seen objects, so we will be able to localize
in the field.

Predicting positions in next cycles

we predict the worst case for next cycles, and then the agents decide what should
they do. goali calculates ball path, and then decide how he can catch the ball
in current situation, he will also consider that the opponent agents in ball path
may kick the ball. we find the nearest players to the ball, according to their
distance and rotation in the field, and then we calculate which players are able
to kick the ball, and we predict ball position in next cycles.