The Vicsek Model

Q6

Parameter:

R\_predator: the radius within which the predator will chase the preys

R\_run\_away: the radius within which the preys will detect the predator and try to run away

For each time step:

First iterate the prey ndarray, calculate the distance between each prey and the predator, if the distance between them is less than max(R\_predator, R\_run\_away), then return the according prey index and the run away vector(use polar coordinates(r,theta), pointing from the predator to the prey) in the form of two ndarrays.

Then check that whether the distance between the closest prey to the predator is less than (V\_predator – V\_prey)/2. If the condition is satisfied, we assume the prey is eaten by the predator during this time step and delete it from the prey ndarray. (adjust the prey index and run away vector accordingly)

Then we calculate the distance matrix between the prey. As before, calculate the angle based on rule of alignment and store it in heading.

How to decide the direction of the prey?(My own thought of Mathematical modelling, without reference to any papers or online materials)

theta(ith prey) = heading(ith prey)

if distance(ith prey, predator) R\_run\_away

theta(ith prey) = angle((cos(run\_away\_angle (ith bird)),sin(run\_away\_angle(ith bird)))+(cos(heading(ith prey)), sin(heading(ith prey)))

if distance(ith prey, predator) R\_run\_away

How to decide the direction of the predator?(My own thought of Mathematical modelling, without reference to any papers or online materials)

select the preys within R\_predator and denote it as run\_after\_prey

theta(predator) = angle()