Artificial Intelligence (AI) Continued3...

Group Steering Behaviours

Steering behaviours can be divided into two groups, simple behaviours for individuals and pairs; and combined behaviours for groups. A taxonomy of the steering behaviours presented by Reynolds appears in Figure 1. Seek, flee, pursuit, evasion form a base for many others.

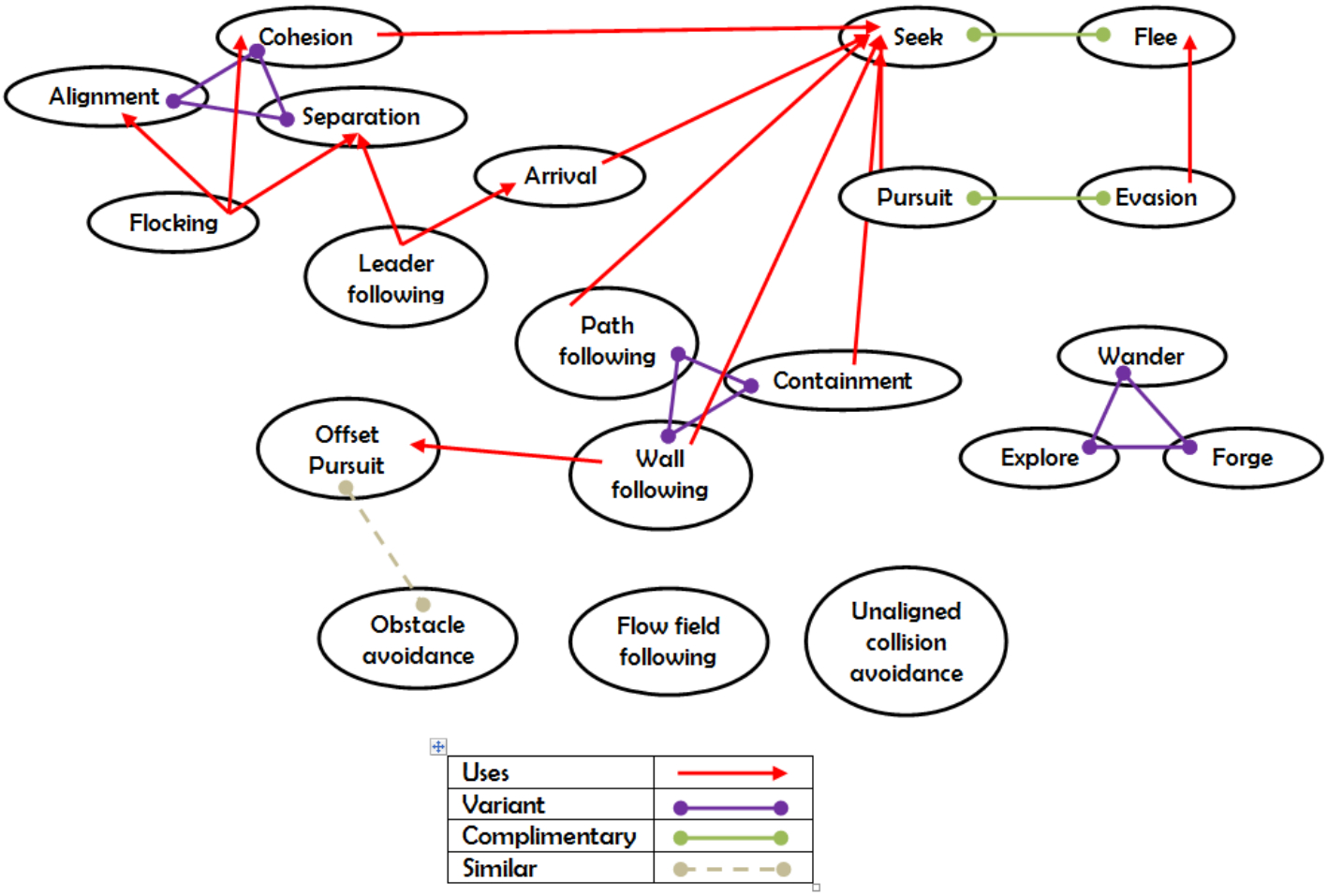

Figure 1. Steering Behaviours

Concepts: Group Behaviours

Once we've mastered control over a single object navigating its environment, we can begin to experiment with a group of autonomous agents, each steering according to the relative positions and velocities of its neighbours. One of the most famous examples is Reynolds' rules for flocking Boids which incorporates the following three rules:

1. Avoidance/Separation: Determine if you are too close to any other boids. If you are then adjust your direction to avoid collision.

2. Copy/Alignment: Take the average of all the other boids's velocities and adjust your velocity to move in the general direction of the flock.

3. Center/Cohesion: Compute the center of the entire flock and steer towards the center.

Algorithms:

Generalized program structure for the boids can be described as

```
Init(){
        initialise_boids_positions()}

Update(){
            Update_boids_positions()}
```

Initialise_boids_positions() assigns a starting position to each of the boids, typically out of screen somewhere to avoid their random mid-air appearance.

Update_boids_positions() contains the actual boids algorithms which are essentially simple vector operations on positions of all the boids. Typically, every boid has one component of velocity pertaining to each rule (V_1, V_2, V_3, ..., V_n) to provide precise control. Summation of all these components SUM(V_1, V_2, V_3, ..., V_n) yields the final velocity component of the boid.

```
FOR EACH BOID b
      For (int i=0; i < n; i++)
            Vi = Rulei (b)
            b.velocity += Vi
      end
  b.position += b.velocity
END
```

Three rules, Avoidance/Separation, Copy/Alignment, and Center/Cohesion are explained in the previous sections. Additional rules can be introduced simply by defining the rule in inner for loop of Update_boids_positions method.

Sample Rule:

```
Cohesion Rule (boid bi)
{
        Vector Percieved_Centeri
        FOR EACH BOID b
            IF (b != bi)
                Percieved_Centeri + = b.position
        END
        Percieved_Centeri /=  n-1
        RETURN (pcJ - bJ.position) / 100
}
```

Tasks:

1. Create classes for Group steering behaviours.
2. Update the DroneBehavior and SwarmBehavior scripts to achieve the behaviour depicted in the attached video.
3. Try out additional rules like, strong pull, strong push, limiting the fly-zone, etc...