Algorithm 1: Hierarchical Paradigm with *Fuzzy* C-*means* (H1) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if general coordinator then
        if t mod γ = 0 then
            Receives the message from the UAVs with their positions and their targets observed ;
            Execute FCM(iterations=10,dist = "euclidean",weights = 1, centers=UAV positions);
            Send a message to the UAVs with the new centers requested;
        end
    else
        if t mod γ = 0 then
            Sends a message to the general coordinator informing its position and targets observed;
            Receives from the general coordinator the action requested with the new centres;
            Moves in straight line to the new center nearest received;
        else
            Moves to the nearest center;
        end
    end
end
```

Algorithm 2: Hierarchical Paradigm with Kohonen Maps (H2) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if general coordinator then
        if t mod γ = 0 then
            Receives the message from the UAVs with their positions and their targets observed ;
            Execute Kohonen(xdim = 4, ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
            Send a message to the UAVs with the new centers requested;
        end
    else
        if t mod γ = 0 then
            Sends a message to the general coordinator informing its position and targets observed;
            Receives from the general coordinator the action requested with the new centres;
            Moves in straight line to the new center nearest received;
        else
            Moves to the nearest center;
        end
    end
end
```

Algorithm 3: Dual Holarchy Paradigm (H3) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if coordinator then
        if t mod γ = 0 then
            if general coordinator then
                Receives the message from the UAVs with their positions and their targets observed ;
                Send a message propagating the information to the coordinators Kmeans and FCM ;
            else
                if Kmeans holon coordinator then
                    Receives the message from the general coordinator; Execute Kohonen(xdim = 3,
                      ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
                    Send a message to the UAVs Kohonen with the new centers requested;
                else if FCM holon coordinator then
                    Receives the message from the general coordinator; Execute FCM(iterations=10,dist =
                      "euclidean",weights = 1, centers=UAV positions);
                    Send a message to the UAVs FCM with the new centers requested;
            end
        end
    else
        if t mod γ = 0 then
            if Kohonen UAVs then
                Sends a message to the general coordinator informing its position and targets observed;
                Receives from the coordinator of the holon Kohonen the action requested with the new
                  centres;
                Moves in a straight line to the new center Kohonen nearest received;
            else if FCM VANTs then
                Sends a message to the general coordinator informing its position and targets observed;
                Receives from the coordinator of the holon FCM the action requested with the new
                  centres;
                Moves in a straight line to the new center FCM nearest received;
        else
            Move to the center closest of your holon;
        end
    end
end
```

Algorithm 4: Triple Holarchy Paradigm (H4) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if coordinator then
        if t mod γ = 0 then
            if general coordinator then
                Receives the message from the UAVs with their positions and their targets observed ;
                Send a message propagating the information to the coordinators Kmeans, FCM and DBSk;
            else
                if Kohonen holon coordinator then
                    Receives the message from the general coordinator; Execute Kohonen(xdim = 2,
                      ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
                    Send a message to the UAVs Kohonen with the new centers requested;
                else if FCM holon coordinator then
                    Receives the message from the general coordinator; Execute FCM(iterations=10,dist =
                      "euclidean",weights = 1, centers=UAV positions);
                    Send a message to the UAVs FCM with the new centers requested;
                else if DBSk holon coordinator then
                    Receives the message from the general coordinator; Execute DBSk(ϵ = r/1.5, MinPts =
                      2, K = 4, iterationsKM=10) ;
                    Send a message to the UAVs DBSk with the new centers requested;
            end
        end
    else
        if t mod γ = 0 then
            if Kohonen UAVs then
                Sends a message to the general coordinator informing its position and targets observed;
                Receives from the coordinator of the holon Kohonen the action requested with the new
                  centres;
                Moves in a straight line to the new center Kohonen nearest received;
            else if FCM VANTs then
                Sends a message to the general coordinator informing its position and targets observed;
                Receives from the coordinator of the holon FCM the action requested with the new
                  centres;
                Moves in a straight line to the new center FCM nearest received;
            else if DBSk UAVs then
                Sends a message to the general coordinator informing its position and targets observed;
                Receives from the coordinator of the holon DBSk the action requested with the new
                  centres;
                Moves in a straight line to the new center nearest received DBSk;
        else
            Move to the center nearest of your holon;
        end
    end
end
```

Algorithm 5: Double Coalition Paradigm (C1) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if position X of UAV between 0 and 75 then
        receive messages from coalition 1;
    else if position X of UAV between 76 and 150 then
        receive messages from coalition 2;
    if VANT belong the coalition1 then
        coalition1 leader ← draw(coalition1 UAVs) ;
        if coalition leader1 then
            if t mod γ = 0 then
                Receives the message from the UAVs of the coalition1 with their positions
                  and their targets observed;
                q ← Number of UAVs in coalition1;
                Execute Kohonen(xdim = q//2, ydim=2, iterations=1500, alpha = 0.08,
                  top=hexagonal);
                Sends a message to the UAVs of the coalition1 with the new centers
                  requested;
            end
        else
            Receives the message from the UAVs of the coalition1 with their positions and
              their targets observed;
            Send a message to the VANts of coalition1 informing its position and targets observed;
            Moves in a straight line to the new center Kohonen nearest received;
        end
    else if VANT belong the coalition2 then
        coalition leader2 ← draw(coalition UAVs2) ;
        if coalition leader2 then
            if t mod γ = 0 then
                Receives the message from the UAVs of the coalition2 with their positions and
                  their targets observed;
                q ← Number of UAVs in coalition2;
                Execute Kohonen(xdim = q/2, ydim=2, iterations=1500, alpha = 0.08,
                  top=hexagonal);
                Sends a message to the UAVs of the coalition2 with the new centers
                  requested;
            end
        else
            Receives the message from the UAVs of the coalition2 with their positions and
              their targets observed;
            Send a message to the UAVs of the coalition2 informing its position and targets
              observed;
            Moves in a straight line to the new center Kohonen nearest received;
        end
end
```

Algorithm 6: Quadruple Coalition Paradigm (C2) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if position X of UAV between 0 and 75 and position Y of UAV between 0 and 75 then
        receive messages from coalition 1;
    else if position X of UAV between 76 and 150 and position Y of UAV between 76 and 150 then
        receive messages from coalition 2 ;
    else if position X of UAV between 76 and 150 and position Y of UAV between 0 and 75 then
        receive messages from coalition 3;
    else if position X of UAV between 0 and 75 and position Y of UAV between 76 and 150 then
        receive messages from coalition 4 ;
    if VANT belong the coalition1 then
        coalition1 leader ← draw(coalition1 UAVs) ;
        if coalition leader1 then
            if t mod γ = 0 then
                Receives the message from the UAVs of the coalition1 with their positions and their
                  targets observed;
                q ← Number of UAVs in coalition1;
                Execute Kohonen(xdim = q//2, ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
                Sends a message to the UAVs of the coalition1 with the new centers requested;
            end
        else
            Receives the message from the UAVs of the coalition1 with their positions and their
              targets observed;
            Send a message to the UAVs of coalition1 informing its position and targets observed;
            Moves in a straight line to the new center Kohonen nearest received;
        end
    else if VANT belong the coalition2 then
        coalition leader2 ← draw(coalition UAVs2) ;
        if coalition leader2 then
            if t mod γ = 0 then
                Receives the message from the UAVs of the coalition2 with their positions and their
                  targets observed;
                q ← Number of UAVs in coalition2;
                Execute Kohonen(xdim = q//2, ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
                Sends a message to the UAVs of the coalition2 with the new centers requested;
            end
        else
            Receives the message from the UAVs of the coalition2 with their positions and their
              targets observed;
            Send a message to the UAVs of the coalition2 informing its position and targets observed;
            Moves in a straight line to the new center Kohonen nearest received;
        end
    else if VANT belongr a coalition3 then
        coalition leader3 ← draw(coalition UAVs3) ;
        if coalition leader3 then
            if t mod γ = 0 then
                Receives the message from the UAVs of the coalition3 with their positions and their
                  targets observed;
                Execute FCM(iterations=10,dist = "euclidean",weights = 1, centers=UAV positions);
                Send a message to the UAVs of the coalition3 with the new centers requested;
            end
        else
            Receives the message from the UAVs of the coalition3 with their positions and their
              targets observed;
            Send a message to the UAVs of the coalition3 informing its position and targets observed;
            Moves in a straight line to the new center FCM nearest received;
        end
    else if VANT belong the coalition4 then
        coalition leader4 ← draw(coalition UAVs4) ;
        if coalition leader4 then
            if t mod γ = 0 then
                Receives the message from the UAVs of the coalition4 with their positions and their
                  targets observed;
                Execute FCM(iterations=10,dist = "euclidean",weights = 1, centers=UAV positions);
                Sends a message to the UAVs of the coalition3 with the new centers requested;
            end
        else
            Receives the message from the UAVs of the coalition4 with their positions and their
              targets observed;
            Send a message to the UAVs of the coalition4 informing its position and targets observed;
            Moves in a straight line to the new center FCM nearest received;
        end
end
```

Algorithm 7: Dual Federation Paradigm (F1) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if number of targets observed by UAV = 0 then
        receive messages from explorer federation;
    else if number of targets observed by UAV > 0 then
        receive messages from federation observer;
    if VANT belong the observer federation then
        if federation delegate then
            Receives the message from the UAVs of the federation and from the delegate of the
              explorer federation with the positions and targets observed;
            q ← Number of UAVs in the observer federation ;
            Execute Kohonen(xdim = q//2, ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
            Sends a message to the UAVs of the observer federation with the requested new centres;
        else
            Send a message to the delegate of the observing federation informing its position and targets
              observed;
            Receives from the delegate of the observer federation the action requested with the new
              centres;
            Moves in a straight line to the new center nearest Kohonen ;
        end
    else if VANT belongr the observer federation then
        if explorer federation delegate then
            Sends a message from the UAVs of the explorer federation with their positions and their
              targets observed to the delegate of the explorer federation;
        else
            Send a message to the delegate of the exploring federation informing its position and targets
              observed;
            moves randomly exploring the environment;
        end
end
```

Algorithm 8: Triple Federation Paradigm (F2) in CMOMMT-URBAN3D

input : Perceptions of agents.
output : Decision making of the organization.

```
while t < Δt do
    if number of targets observed by UAV = 0 then
        receive messages from explorer federation;
    else if number of targets observed by UAV > 0 and =< 12 then
        receive messages from observer federation;
    else if number of targets observed by UAV > 12 then
        receive messages from federation guard;
    if VANT belong the observer federation then
        if federation delegate then
            Receives the message from the UAVs of the federation and from the delegate of the
              explorer federation with the positions and targets observed;
            q ← Number of UAVs in the observer federation ;
            Execute Kohonen(xdim = q//2, ydim=2, iterations=1500, alpha = 0.08, top=hexagonal);
            Sends a message to the UAVs of the observer federation with the new centers requested;
        else
            Send a message to the delegate of the observing federation informing its position and targets
              observed;
            Receives from the delegate of the observer federation the action requested with the new
              centres;
            Moves in a straight line to the new center nearest Kohonen ;
        end
        else
            move randomly;
        end
    else if VANT belongr the observer federation then
        if explorer federation delegate then
            Send the message from the UAVs of the explorer federation with their positions and their
              targets observed to the delegate of the explorer federation and guard ;
        else
            Send a message to the delegate of the exploring federation informing its position and targets
              observed;
            moves randomly exploring the environment;
        end
    else if VANT belong the guard federation then
        if guard federation delegate then
            Sends a message from the UAVs of the federation guard with their positions and their
              targets observed to the delegate of the federation observer;
        else
            Sends a message to the federation delegate guard informing its position and targets observed;
            does not move in the environment;
        end
end
```