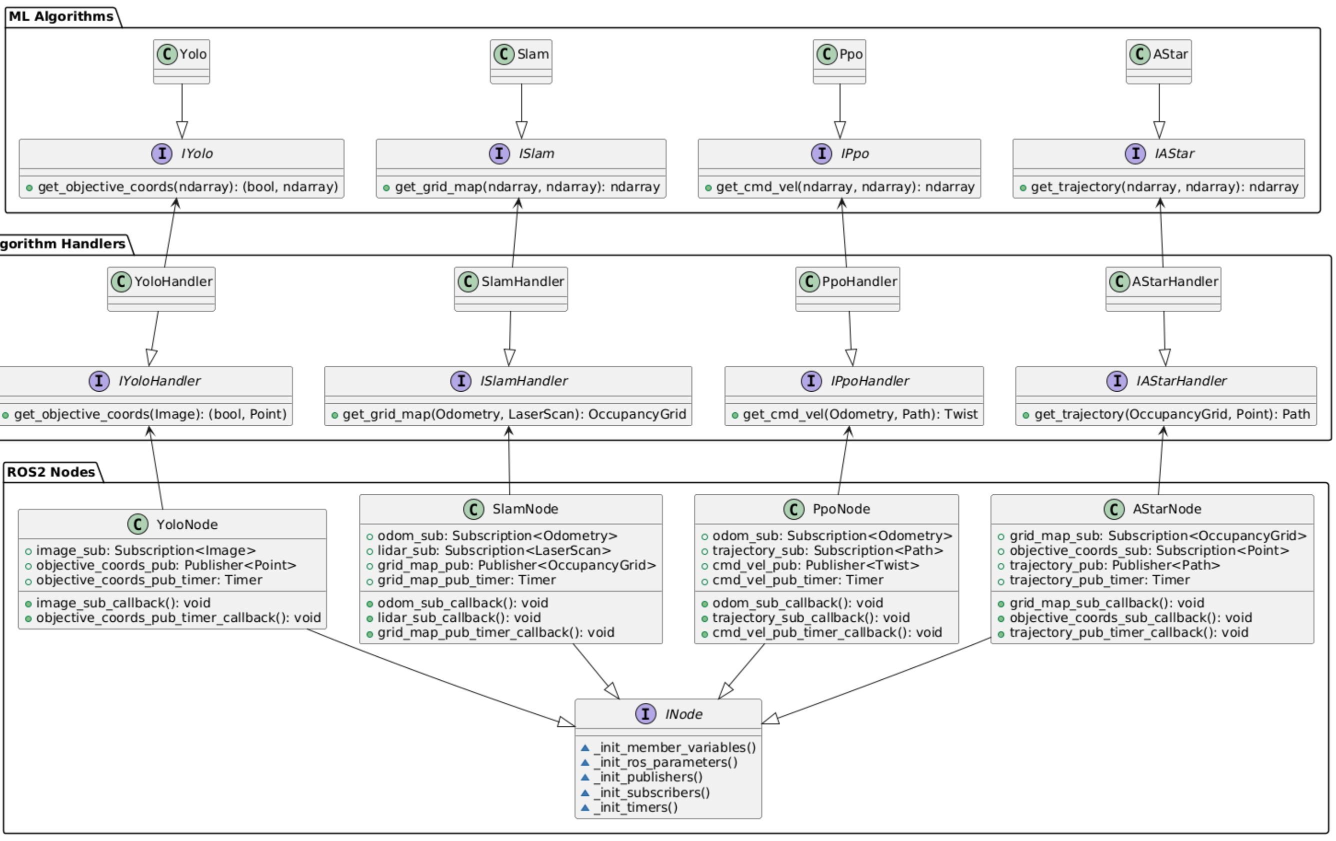
Project Structure

The structure of our project is shown in the diagram below:


ML Algorithms
Yolo
Slam
Ppo
AStar
IYolo
get_objective_coords(ndarray): (bool, ndarray)
ISlam
get_grid_map(ndarray, ndarray): ndarray
IPpo
get_cmd_vel(ndarray, ndarray): ndarray
IAStar
get_trajectory(ndarray, ndarray): ndarray
Algorithm Handlers
YoloHandler
SlamHandler
PpoHandler
AStarHandler
IYoloHandler
get_objective_coords(Image): (bool, Point)
ISlamHandler
get_grid_map(Odometry, LaserScan): OccupancyGrid
IPpoHandler
get_cmd_vel(Odometry, Path): Twist
IAStarHandler
get_trajectory(OccupancyGrid, Point): Path
ROS2 Nodes
YoloNode
image_sub: Subscription<Image>
objective_coords_pub: Publisher<Point>
objective_coords_pub_timer: Timer
image_sub_callback(): void
objective_coords_pub_timer_callback(): void
SlamNode
odom_sub: Subscription<Odometry>
lidar_sub: Subscription<LaserScan>
grid_map_pub: Publisher<OccupancyGrid>
grid_map_pub_timer: Timer
odom_sub_callback(): void
lidar_sub_callback(): void
grid_map_pub_timer_callback(): void
PpoNode
odom_sub: Subscription<Odometry>
trajectory_sub: Subscription<Path>
cmd_vel_pub: Publisher<Twist>
cmd_vel_pub_timer: Timer
odom_sub_callback(): void
trajectory_sub_callback(): void
cmd_vel_pub_timer_callback(): void
AStarNode
grid_map_sub: Subscription<OccupancyGrid>
objective_coords_sub: Subscription<Point>
trajectory_pub: Publisher<Path>
trajectory_pub_timer: Timer
grid_map_sub_callback(): void
objective_coords_sub_callback(): void
trajectory_pub_timer_callback(): void
INode
_init_member_variables()
_init_ros_parameters()
_init_publishers()
_init_subscribers()
_init_timers()

The larger boxes represent packages or "layers" of our project. The code is divided into these layers to allow for the separation of concerns. Each layer does not need to know about the existance of the layers beneath it, and only needs to know about the interfaces of the layer above it. This makes the code more modular and easier to change and maintain.

Each of the smaller boxes represents a class in our project. The text in each of these boxes represents the class's functions or data members. Of particular importance are the public functions (preceded by a green dot) defined in the interface classes (which have a purple symbol and start with an *I*). These are the functions that connect different layers of code together, and they **must be implemented** in their **non-interface counterparts** for the code to work.

This also specifies the *"is a"* and *"has a"* relationship between each of the classes. The closed white arrows show an *"is a"* relationship, which means that a class inherits whichever class it points to. The open black arrows show a *"has a"* relationship, which means that a class contains an instance of whichever class it points to.

It is important that the arrows between each layer point in only one direction (regardless of which type of arrow they are), because it removes cyclic dependencies and allows you to work on the upper layers without having to worry about the lower layers.

Each of these layers--*ML Algorithms*, *Algorithm Handlers*, and *ROS2 Nodes*--are detailed below.

ML Algorithms

This is where the ML algorithms are implemented. The only classes that you need to edit are the **non-interface classes** (the classes whose names do not start with an *I*). These classes implement the outward-facing functions specified in the interface classes, but can have numerous internal "helper functions" (as many as you'd like). As long as you implement the outward-facing functions, and as long as the interface classes do not change, everything in the lower layers should work as expected.

NOTE: The interfaces in this layer are subject to change, depending on which inputs and outputs are most convenient for each ML algorithm. In other words, **implement the algorithms without regard for the input or output types**, and then share with the group which inputs/outputs are most convenient. **Do NOT change the interface classes without communicating with the group, or else the lower layers may stop working.**

Algorithm Handlers

This is where "wrapper classes" for the ML algorithms are defined. Basically, these classes convert ROS messages into data that the ML algorithms can use and vice-versa. Their basic functionality is as follows:

1. Convert ROS messages into data for ML algorithm
2. Run ML algorithm
3. Convert results from ML algorithm into ROS messages

This will allow all data conversion, preprocessing, etc. to take place here without making the other layers worry about it.

The only classes that you need to implement are the **non-interface classes** (classes whose names do not start with an *I*). These classes implement the outward-facing functions specified in the interface classes, but can have numerous internal "helper functions" (as many as you'd like). As long as you implement the outward-facing functions, and as long as the interface classes do not change, everything in the lower layers will work as expected.

ROS2 Nodes

These classes implement ROS2 nodes. They pass information to each other through their publishers and receive information through their subscribers. Once information is received, they call upon the algorithm handlers to process incoming data and generate outgoing data.

These node classes are already set up to work with the *Algorithm Handlers* layer's interfaces, so they do not need to be changed.