# Driving Decisions and Actions

Module 1, Lesson 3

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# In this lesson ...

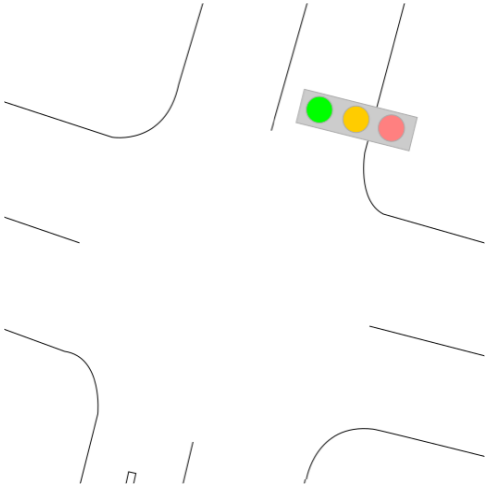
- Planning: types (window of time), examples
- Various decisions needed for a simple intersection scenario
- Types of planning
  - Reactive
  - Predictive

# Planning: Examples

- Making decisions
  - Long term
    - How to navigate from New York to Los Angeles?
  - Short term
    - Can I change my lane to the lane right of me?
    - Can I pass this intersection and join the left road?
  - Immediate
    - Can I stay on track on this curved road?
    - Accelerate or brake, by how much?

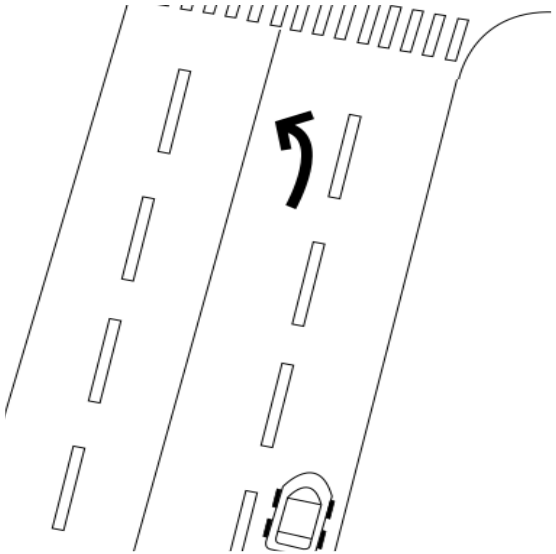
# Example: Turning left at an intersection

- Approaching an intersection to turn left.
- Assume
  - Intersection has traffic lights



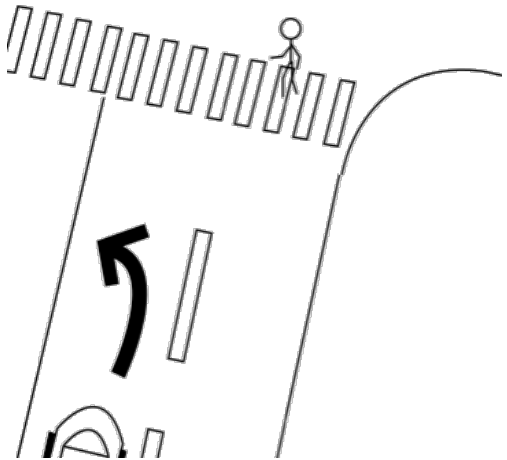
# Example: Turning left at an intersection

- Identify turning lane for left turn.



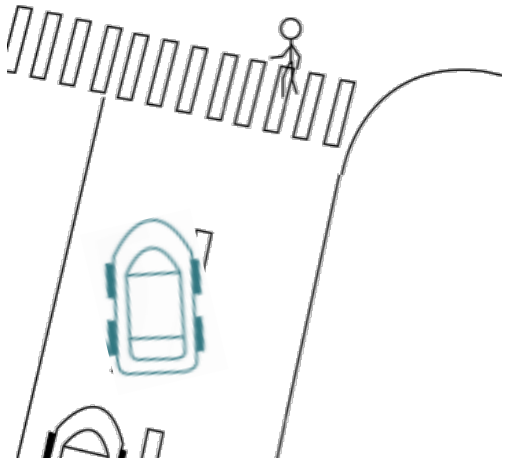
# Example: Turning left at an intersection

- Identify turning lane for left turn.
- Approach the intersection, decelerate smoothly to the stop line.



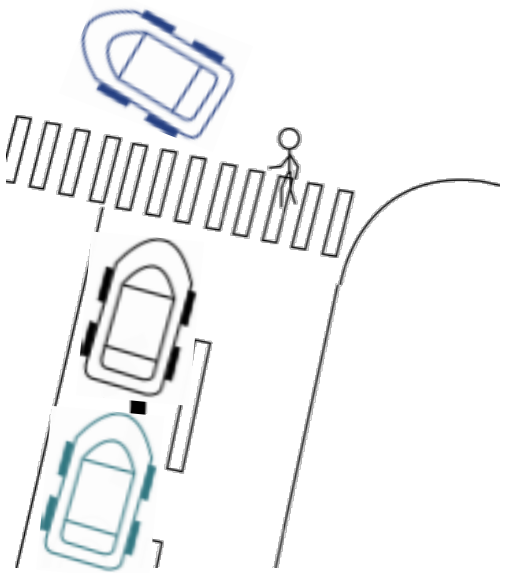
# Example: Turning left at an intersection

- Identify turning lane for left turn.
- Approach the intersection, decelerate smoothly to the stop line.
- What if
  - Vehicle enters turn lane?
  - Pedestrians are crossing?



# Example: Turning left at an intersection

- Identify turning lane for left turn.
- Approach the intersection, decelerate smoothly to the stop line.
- What if
  - Vehicle enters turn lane?
  - Pedestrians are crossing?
  - There are cars behind you?



# Example: Turning left at an intersection

- This was a simple maneuver, yet it takes 3-4 levels of decisions and control to execute
- Consider how many rules would it take to drive
  - safely
  - efficiently
  - following all listed traffic rules
  - only follow those rules everyone else is following!…
- Driving decision making is complicated!

# Reactive Planning

- What we just did was rule based planning
  - Involved decision trees!
- In reactive rule based planning, we have rules that take into account the current state of ego and other objects and give decisions.
- Examples:
  - If there is a pedestrian on the road, stop.
  - If speed limit changes, adjust speed to match it.

# What other types of planning are there?

- Predictive Planning:
  - Make predictions about other vehicles and how they are moving. Then use these predictions to inform our decisions.
  - Example:
    - That car has been stopped for the last 10 seconds. It is going to be stopped for the next few seconds.
    - Pedestrian is jaywalking. She will enter our lane by the time we reach her.

# Summary

- Long term, short term, immediate planning
- Simple intersection "making a left turn" scenario
- Driving is hard!
- Reactive planning, predictive planning

# Module Summary

- In this module,
  - Basic autonomous driving terminology
  - Taxonomy to characterize self-driving capabilities
  - The driving task and the major components of driving: perception, planning and execution.
  - The elements and agents in the environment we need to identify and track for perception.
  - Planning with its different horizons, and looked at some decision making approaches.

- In the next module,
  - Hardware and software elements of self-driving cars