Lesson 5

Bringing human-like reasoning to driverless car navigation

May 23, 2019

Human drivers are exceptionally good at navigating roads they haven't driven on before, using observation and simple tools. We simply match what we see around us to what we see on our GPS devices to determine where we are and where we need to go. Driverless cars, however, struggle with this basic reasoning. In every new area, the cars must first map and analyze all the new roads, which is very time consuming. The systems also rely on complex maps -- usually generated by 3-D scans -- which are computationally intensive to generate and process on the fly.

In a paper being presented at this week's International Conference on Robotics and Automation, MIT researchers describe an autonomous control system that "learns" the steering patterns of human drivers as they navigate roads in a small area, using only data from video camera feeds and a simple GPS-like map. Then, the trained system can control a driverless car along a planned route in a brand-new area, by imitating the human driver. Similarly to human drivers, the system also detects any mismatches between its map and features of the road. This helps the system determine if its position, sensors, or mapping are incorrect, in order to correct the car's course.

To train the system initially, a human operator controlled a driverless Toyota Prius -- equipped with several cameras and a basic GPS navigation system -- collecting data from local suburban streets including various road structures and obstacles. When deployed autonomously, the system successfully navigated the car along a preplanned path in a different forested area, designated for autonomous vehicle tests. "With our system, you don't need to train on every road beforehand," says first author Alexander Amini, an MIT graduate student. "You can download a new map for the car to navigate through roads it has never seen before."

"Our objective is to achieve autonomous navigation that is robust for driving in new environments," adds co-author Daniela Rus, director of the Computer Science and Artificial Intelligence Laboratory (CSAIL). "For example, if we train an autonomous vehicle to drive in an urban setting such as the streets of Cambridge, the system should also be able to drive smoothly in the woods, even if that is an environment it has never seen before."

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A. Skimming

Choose from the list A-E the main idea for paragraphs 1-4. There is one extra letter that you do not need to use.

A. The objective is to achieve autonomous navigation in new environments. ……

B. A human operator has to drive a driverless car. ……..

C. Driverless cars have to struggle to find the right way to go. ……

D. An autonomous control system can control a driverless car along a new area. ……..

E. With the system, the driverless car does not need to be trained on every road beforehand. …

B. Vocabulary.

Circle the letter corresponding to the best answer for each question.

1. The noun "devices" in line 3 can be described as:
a. methods
b. pieces of equipment
c. screens
d. rear mirrors

2. The adjective "autonomous" in line 9 can be understood as:
a. robust
b. expensive
c. sophisticated
d. self-directed

3. The verb "To train" in line 16 can be explained as:
a. To teach
b. To understand
c. To assemble
d. To go by train

4. The noun "data" in line 17 can be understood as:
a. flowers
b. information
c. rocks
d. pictures

5. The adverb "smoothly" in line 28 can be described as:
a. fast
b. recklessly
c. efficiently
d. slowly

C. Comprehension Questions

1. Why is it time consuming for driverless cars to navigate new areas?
    a. Because driverless cars have an autonomous control system.
    b. Because driverless cars must first map and analyze all the new roads.
    c. Because the maps that driverless cars use are complex.
    d. Because driverless cars are expensive.

2. What does the autonomous control system of driverless cars do?
    a. It learns the steering patterns of human drivers.
    b. It generates complex maps to be used on the roads.
    c. It teaches human drivers how to drive carefully.
    d. It opens and closes car doors automatically.

3. What does the autonomous control system do in a similar way to human drivers?
    a. It can increase speed when the roads are in good conditions.
    b. It can change "its mind" and take another road.
    c. It detects any mismatches between its map and features of the road.
    d. It stops when it needs a rest.

4. How was the control system initially trained?
    a. By a robot
    b. By a human operator
    c. By a computer
    d. By a team of experts

5. How can a driverless car navigate through a new environment?
    a. You can download a new map for the car.
    b. You need to train the car on every road beforehand.
    c. You give the car an oral command.
    d. It can't do it.

6. The BEST title for this passage would be:
    a. Cars will be driven by robots soon
    b. Humans should learn to drive through uncharted land
    c. Bringing human-like reasoning to driverless car navigation
    d. Human drivers are exceptionally good at navigating new roads

D. Reference . Write the referent word(s) at the end of each sentence.

1. What does the subject pronoun “they” in line 1 refer to?
2. What does the relative pronoun “which” in line 6 imply?
3. Find a synonym for the noun “scientists” in line 9.
4. What does the noun phrase “the system” in line 13 stand for?
5. What does the subject pronoun “it” in line 23 denote?
6. What does the subject pronoun “it” in line 28 point to?

E. Video-watching. The ethical dilemma of self-driving cars-Patrick Lin Before watching the video discuss the information in this exercise. Then, watch it and check your answers.

1. Self-driving cars are already on the roads and being used by the public. (True/False)

2. One ethical dilemma of self-driving cars is the potential for accidents. (True/False)

3. Self-driving cars are programmed to prioritize the safety of their passengers over the safety of others. (True/False)

4. The ethical dilemma of self-driving cars is easy to solve with clear guidelines and regulations. (True/False)

5. Self-driving cars have the potential to reduce the number of accidents caused by human error. (True/False)

6. Self-driving cars are not capable of making ethical decisions. (True/False)

7. The ethical dilemma of self-driving cars is only relevant in extreme situations, such as a choice between hitting a pedestrian or crashing the car. (True/False)

8. Self-driving cars have the potential to reduce traffic congestion and improve transportation efficiency. (True/False)

9. The development of self-driving cars raises questions about job displacement for human drivers. (True/False)

10. The ethical dilemma of self-driving cars is a new issue that has not been discussed or debated by experts in the field. (True/False)