

# NAVARCH 568 001 WN 2023 Homework 4 PDF

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TOTAL POINTS

**96 / 130**

## QUESTION 1

### 1 Task 1 20 / 20

✓ - 0 pts *Correct*

- 4 pts Incorrect plot for CSM mean
- 4 pts Incorrect plot for CSM variance
- 8 pts No plot for CSM mean
- 8 pts No plot for CSM variance

## QUESTION 2

### Task 2 30 pts

#### 2.1 2A 15 / 15

✓ - 0 pts *Correct*

- 4 pts Incorrect CSM mean
- 4 pts Incorrect CSM variance

#### 2.2 2B 10 / 10

✓ - 0 pts *Correct*

- 2 pts No/incorrect answer for discussion part
- 4 pts No/incorrect plots for CSM mean
- 4 pts No/incorrect plots for CSM variance

#### 2.3 2C 5 / 5

✓ - 0 pts *Correct*

- 2 pts Inaccurate difference description/advantages.

## QUESTION 3

### 3 Task 3 16 / 20

✓ - 0 pts *Correct*

- 4 pts Incorrect plot for S-CSM mean
- ✓ - 4 pts *Incorrect plot for S-CSM covariance*
- 8 pts No plot for S-CSM mean
- 8 pts No plot for S-CSM variance

## QUESTION 4

### Task 4 30 pts

#### 4.1 4A 15 / 15

✓ - 0 pts *Correct*

- 5 pts Incorrect plot for S-CSM mean
- 5 pts Incorrect plot for S-CSM variance
- 2 pts Error in variance plot
- 2 pts Error in mean plot
- 1 pts Minor error in variance plot
- 1 pts Minor error in mean plot

#### 4.2 4B 10 / 10

✓ - 0 pts *Correct*

- 2 pts No/incorrect answer for the discussion part
- 4 pts No/incorrect plot for S-CSM mean
- 4 pts No/incorrect answer for S-CSM variance
- 1 pts Error in variance plot
- 1 pts Error in mean plot

#### 4.3 4C 5 / 5

✓ - **0 pts** *Correct*

- **2 pts** Incorrect difference statement /  
advantages

- **1 pts** Insufficient discussion

- **5 pts** No statement

#### QUESTION 5

#### 5 Task 5 0 / 30

- **0 pts** Correct

- **15 pts** Minor mistake

✓ - **30 pts** *No answer*

## NA 568 Mobile Robotics: Methods & Algorithms Winter 2023 – Homework 4 – Mapping

### Task 1: Discrete Counting Sensor Model

Grid size: 0.135



Figure 1: OGM Discrete CSM Mean

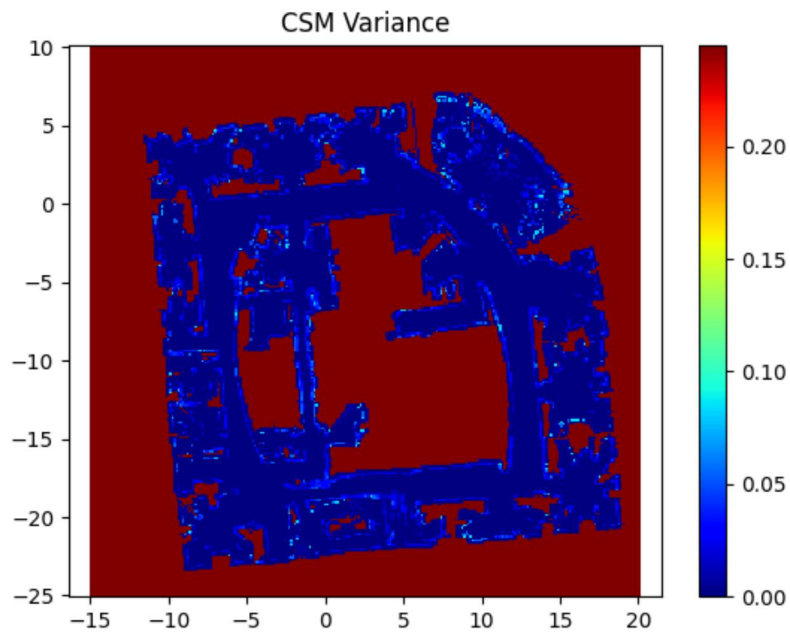


Figure 2: OGM Discrete CSM Variance

## 1 Task 1 20 / 20

✓ - 0 pts *Correct*

- 4 pts Incorrect plot for CSM mean
- 4 pts Incorrect plot for CSM variance
- 8 pts No plot for CSM mean
- 8 pts No plot for CSM variance

## Task 2: Continuous Counting Sensor Model

A. Grid size: 0.135

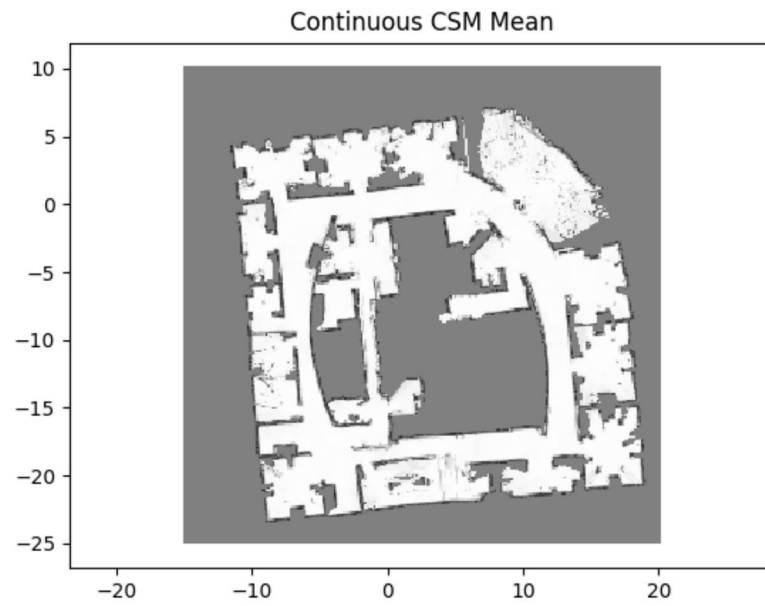


Figure 3: OGM Continuous CSM Mean

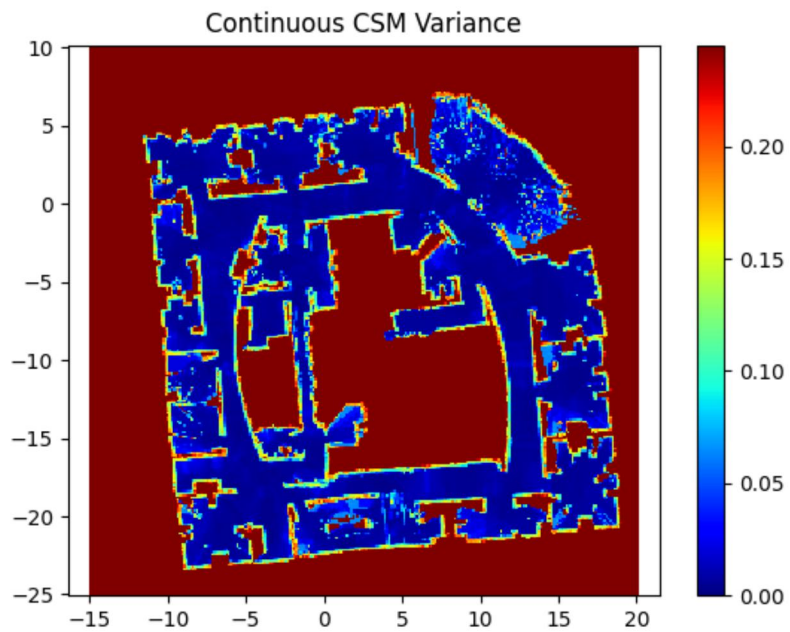


Figure 4: OGM Continuous CSM Variance

2.1 2A 15 / 15

✓ - 0 pts *Correct*

- 4 pts Incorrect CSM mean

- 4 pts Incorrect CSM variance

B. Comparison of plots for grid sizes = [0.135, 0.270, 0.5]

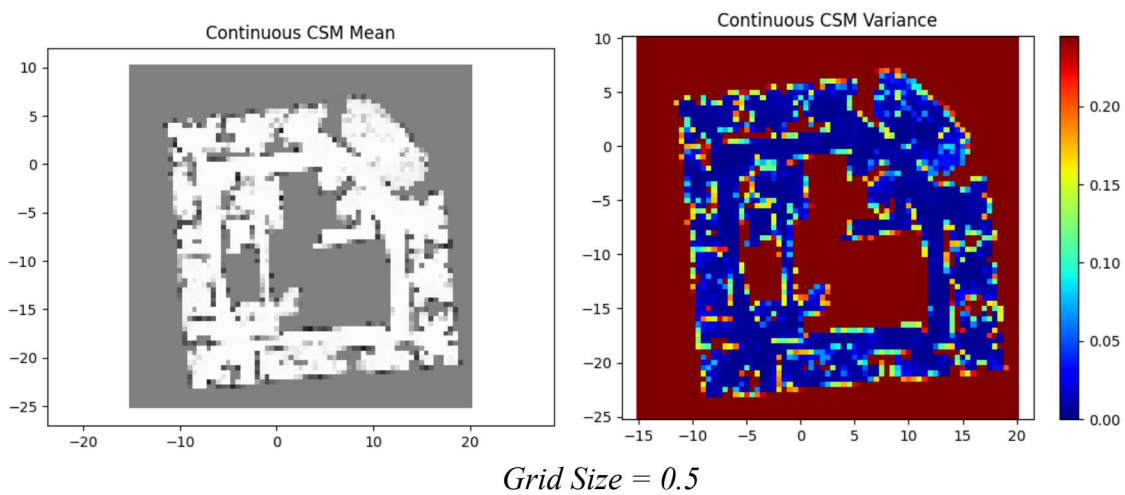
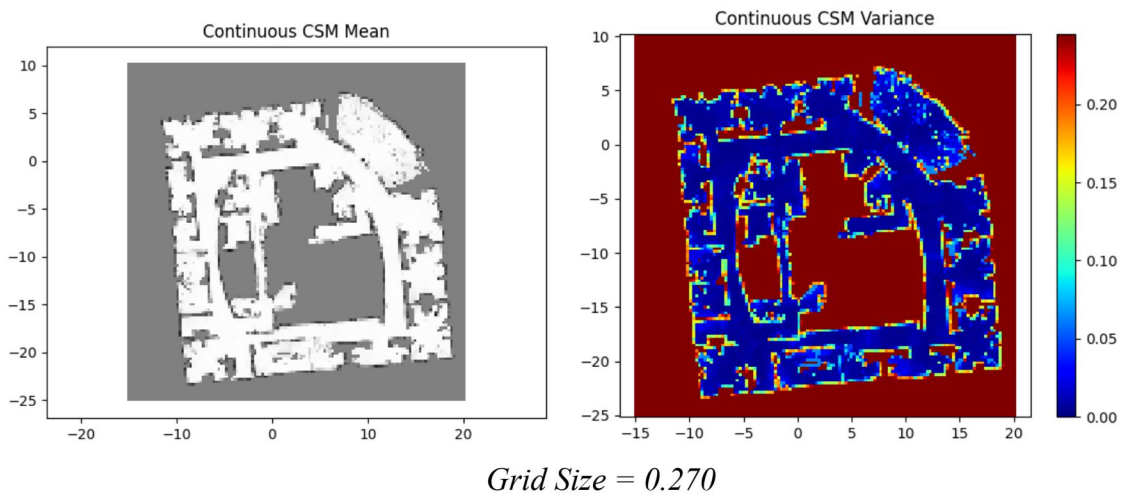
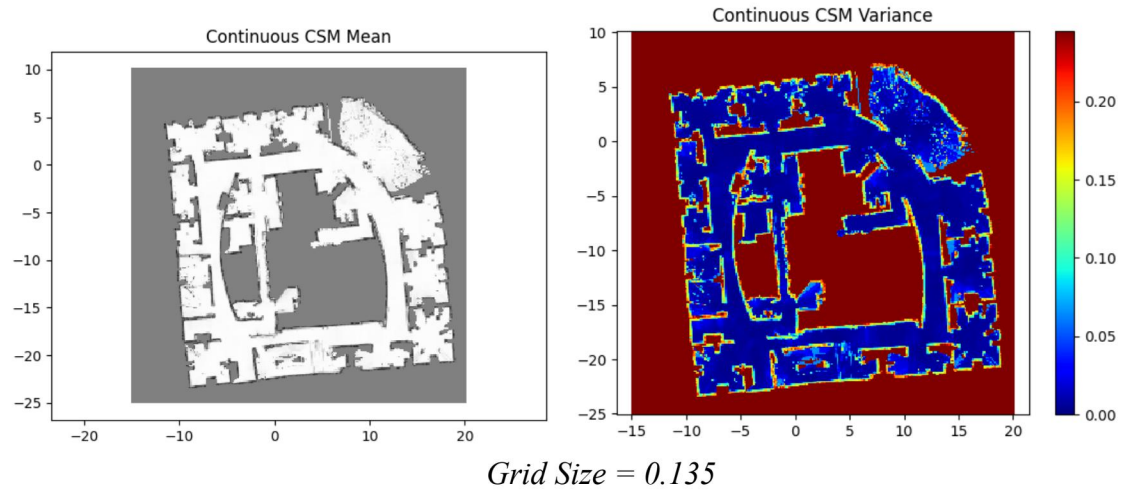


Figure 5: Map Comparison for Continuous CSM: Grid Sizes = [0.135, 0.270, 0.5]

2.2 2B 10 / 10

✓ - 0 pts *Correct*

- 2 pts No/incorrect answer for discussion part

- 4 pts No/incorrect plots for CSM mean

- 4 pts No/incorrect plots for CSM variance



It is evident that as the grid size of the plot increases, the resolution of the plot decreases. The plots progressively lose clarity, making the map less reliable.

- C. Continuous counting sensor models and discrete counting sensor models differ in their method of counting and measuring data.

**Discrete CSM:** In a discrete counting sensor model, the sensor measures data in discrete intervals or counts. The sensor may only output discrete values, such as 0, 1, 2, 3, etc., and cannot provide information about the exact timing or speed of the motion.

**Continuous CSM:** A continuous counting sensor model measures data continuously over time. These sensors can provide real-time information about the measured variable. The sensor may output a continuous stream of values, providing a more detailed and accurate representation of the measured variable.

**Advantages:**

- Continuous CSM provide more precise and detailed information about the measured variable, as they can capture changes in the variable over time. This can be particularly useful in applications such as process control or monitoring, where real-time and accurate data is critical for making decisions and performing actions.
- Continuous CSM can also capture trends and patterns in the data, which can provide valuable insights into the behavior of the measured variable. This can be useful in applications such as predictive maintenance or anomaly detection, where detecting changes in behavior or trends can help identify potential issues before they become critical.

2.3 2C 5 / 5

✓ - 0 pts *Correct*

- 2 pts Inaccurate difference description/advantages.

### Task 3: Discrete Semantic Counting Sensor Model

Grid Size: 0.135

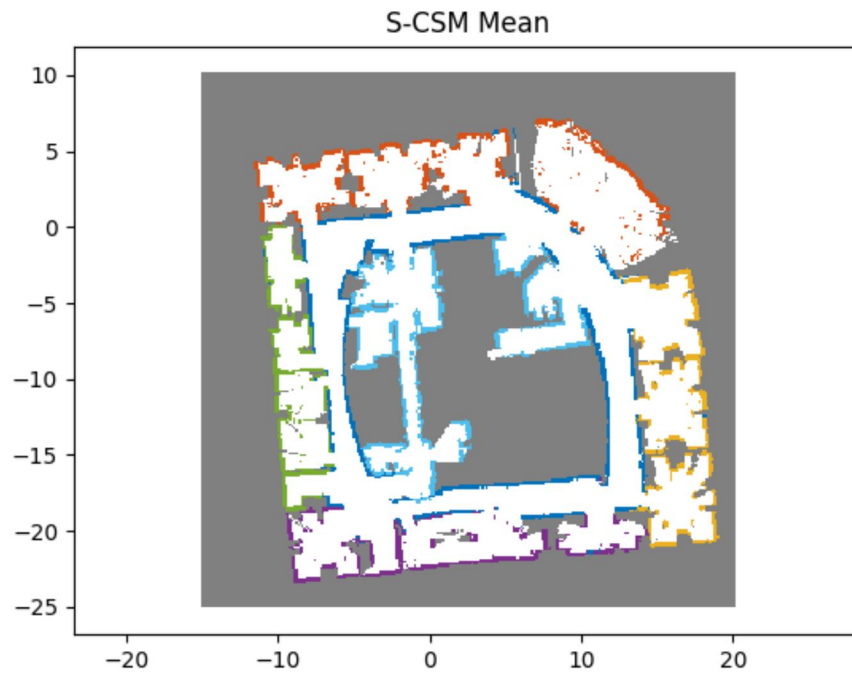


Figure 6: OGM Discrete Semantic CSM Mean

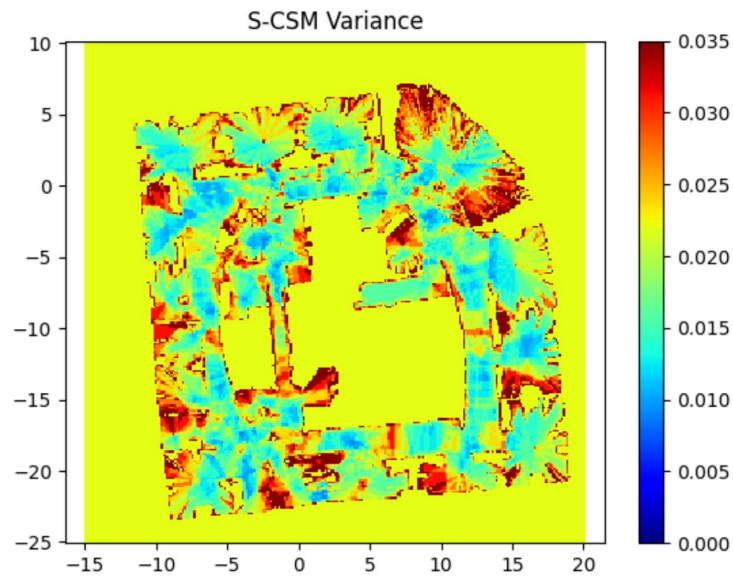


Figure 7: OGM Discrete Semantic CSM Variance

### 3 Task 3 16 / 20

✓ - 0 pts *Correct*

- 4 pts Incorrect plot for S-CSM mean

✓ - 4 pts *Incorrect plot for S-CSM covariance*

- 8 pts No plot for S-CSM mean

- 8 pts No plot for S-CSM variance

#### Task 4: Continuous Semantic Counting Sensor Model

A. Grid Size: 0.135

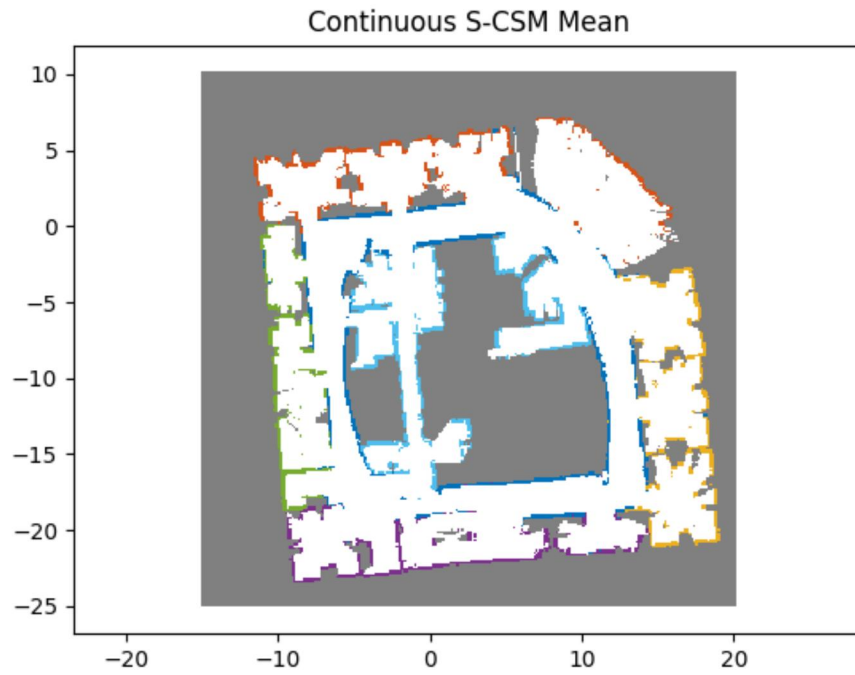


Figure 8: OGM Continuous Semantic CSM Mean

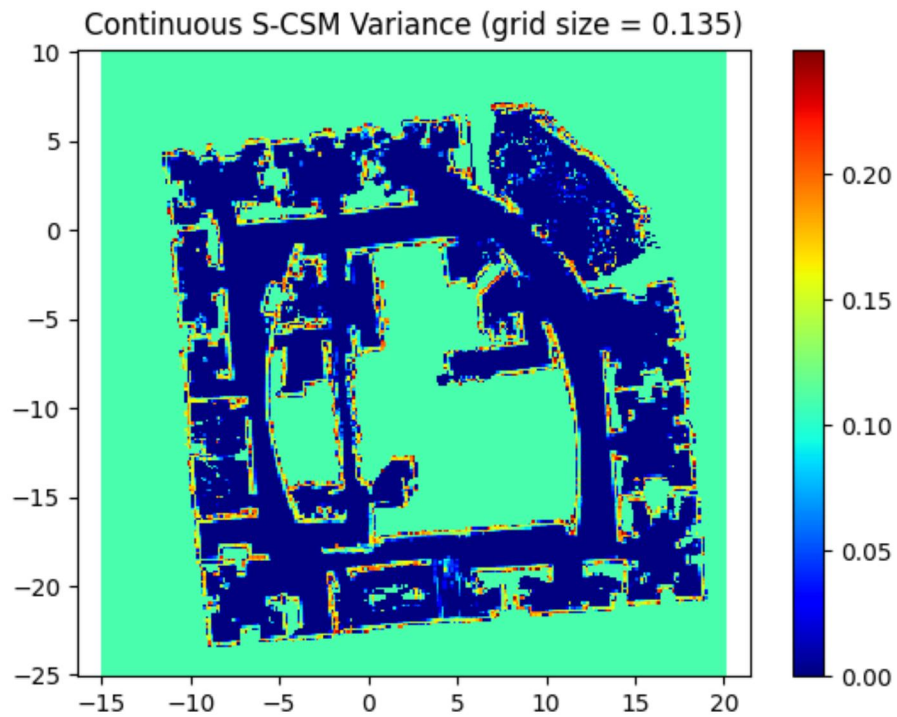


Figure 9: OGM Continuous Semantic CSM Mean

4.1 4A 15 / 15

✓ - 0 pts *Correct*

- 5 pts Incorrect plot for S-CSM mean
- 5 pts Incorrect plot for S-CSM variance
- 2 pts Error in variance plot
- 2 pts Error in mean plot
- 1 pts Minor error in variance plot
- 1 pts Minor error in mean plot

B. Comparison of plots for grid sizes = [0.135, 0.270, 0.5]

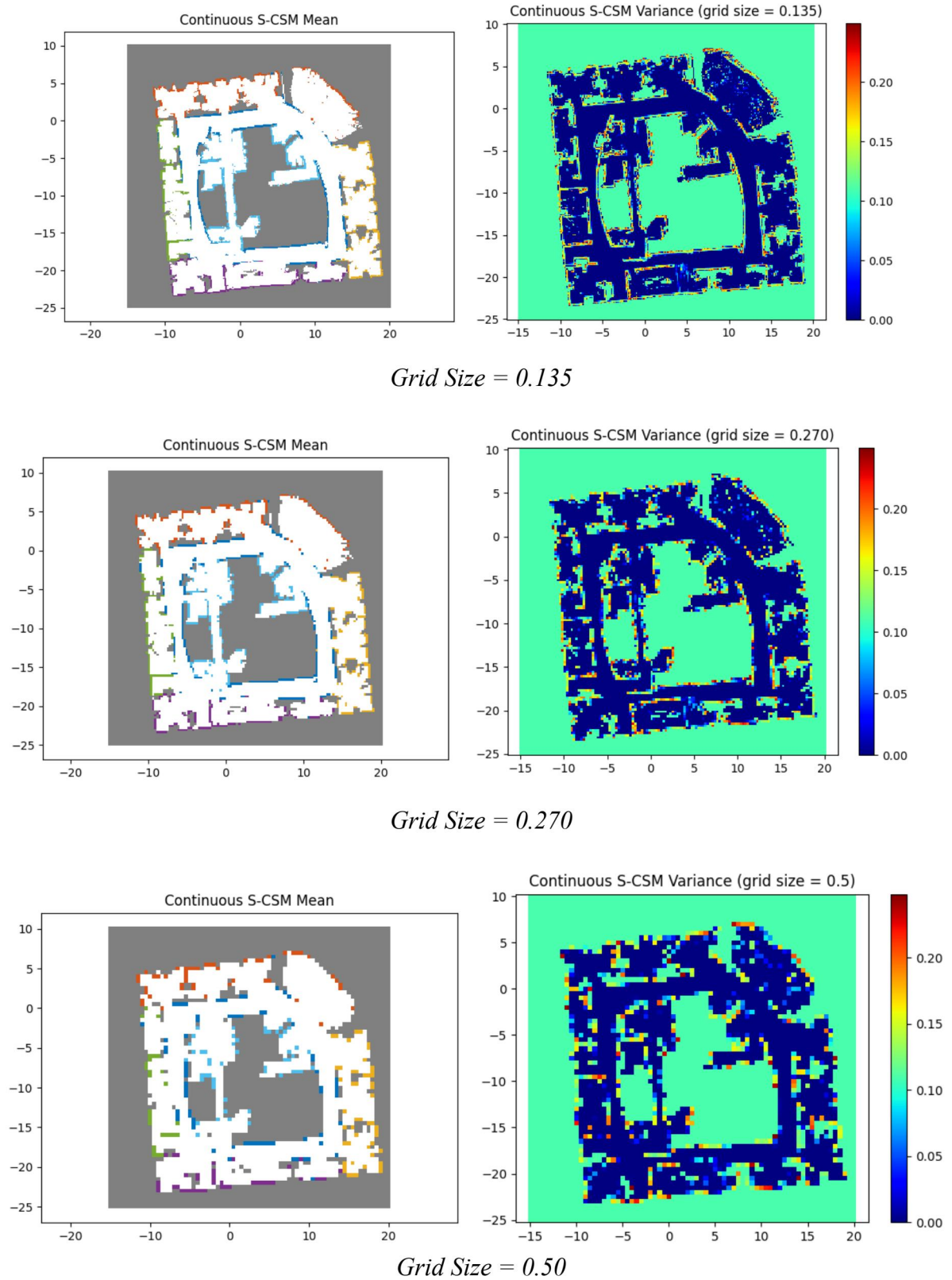


Figure 10: Map Comparison for Continuous S-CSM: Grid Sizes = [0.135, 0.270, 0.5]

4.2 4B 10 / 10

✓ - 0 pts *Correct*

- 2 pts No/incorrect answer for the discussion part
- 4 pts No/incorrect plot for S-CSM mean
- 4 pts No/incorrect answer for S-CSM variance
- 1 pts Error in variance plot
- 1 pts Error in mean plot



It is evident that as the grid size of the plot increases, the resolution of the plot decreases. The plots progressively lose clarity, making the map less reliable.

- C. **Discrete Semantic CSM:** A discrete semantic counting sensor model captures and reports data in a series of discrete time intervals or steps. This means that the sensor captures data periodically at specific time intervals, and reports this data in discrete, separate chunks. A discrete semantic counting sensor model provides a more summarized view.

**Continuous Semantic CSM:** A continuous semantic counting sensor model continuously monitors and reports data at a constant rate, without any interruptions. This means that the sensor reports data in real-time and provides a continuous stream of information. A continuous semantic counting sensor model provides a more detailed and granular picture of the events being monitored.

**Advantages:**

- The advantage of a continuous semantic-counting sensor model is that it can provide more accurate and detailed information than a discrete semantic-counting sensor model. This is because a continuous model can capture more information about the data being sensed, such as the rate of change of the data over time, which can be useful in many applications.

A continuous semantic counting sensor model may be better suited for a robot that requires real-time data for precise control and navigation. For example, a robot that is required to move quickly and avoid obstacles in real-time would benefit from a continuous model that can provide a constant stream of data.

On the other hand, a discrete semantic counting sensor model may be more appropriate for a robot that performs periodic tasks or operates in an environment where a summary of data at specific time intervals is sufficient. For example, a robot that performs inventory checks in a warehouse may only require data on inventory counts at specific intervals rather than a continuous stream of data.

4.3 4C 5 / 5

✓ - 0 pts *Correct*

- 2 pts Incorrect difference statement / advantages

- 1 pts Insufficient discussion

- 5 pts No statement

## 5 Task 5 0 / 30

- 0 pts Correct

- 15 pts Minor mistake

✓ - 30 pts *No answer*