Detect Result for the data set hit_0_bbgem_304

Channal : moduleld 1 stripID 300 axisID 1

The length of the data set is : 30006912

The raw data set has many peaks, however, the background the data has no change.

We add sudden change in the raw data set start at index $m_1$ and end at index $m_2$,

$$data[m_1 : m_2] = data[m_1 : m_2] + \sigma * \text{std(data)}$$

we choose $m_1 = \frac{1}{4} * \text{the length of data}$, $m_3 = \frac{3}{4} * \text{the length of data}$, $\text{std(data)}$ is the standard deviation of the data set, the parameter $\sigma$ decide the amplitude of the sudden change we add in the raw data set.

The goal of our detect results :

- Can we detect the sudden change in the data set?
- For a fix scale, is there exists a small amplitude of the sudden change?

To answer these question, I fix the 'level', and then change the parameter $\sigma$ to find the smallest one. The $\sigma$ I choose are 18, 12, 6, 3, 1, 0.5, 0.2. To make the result more intutitive, I use red color to plot the change interval data and use blue color to plot the unchange interval data.

Scale 7
scale 7

change happens in red data interval

value of data

scale 7

change happens in red data interval

value of data

scale 7

change happens in red data interval

value of data
conclusion:

- we can detect all large peaks in the data set.
- the smallest $\sigma$ is 3

Scale 8
conclusion :

- we can detect most large peaks in the data set.
- the smallest $\sigma$ is 3
Scale 9

![Graph 1](image1.png)

![Graph 2](image2.png)

![Graph 3](image3.png)

![Graph 4](image4.png)
conclusion:

- we can detect most large peaks in the data set.
- the smallest $\sigma$ is 3
conclusion:

- we can detect most large peaks in the data set.
- the smallest $\sigma$ is 3
Scale 11
conclusion:

- No peaks have been detected, we only detected the sudden changes.
- The smallest $\sigma$ is 1

scale 12
conclusion:

- No peaks has been detected, we only detected the sudden changes.
- the smallest $\sigma$ is 1
scale 13

change happens in red data interval

scale 13

change happens in red data interval

scale 13

change happens in red data interval

scale 13

change happens in red data interval
conclusion:

- No peaks has been detected, we only detect the sudden change.
- the smallest $\sigma$ is 0.5

**scale 14**
Conclusion:

- No peaks are detected, we only detect the sudden change.
- The smallest $\sigma$ is 0.5

Summary

- In the small scale, we can detect most peaks in the data set. In the large scale, we can detect sudden change.
- For each fixed scale, we change the $\sigma = 18, 12, 6, 3, 1, 0.5, 0.2$ to find the smallest parameter. We obtain the following relation:

<table>
<thead>
<tr>
<th>Scale</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallest $\sigma$</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>
In [ ]: