(ENKEMNA0302) Applied Linear Algebra

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Airy disc I

- During most of the practice, I finished the material from the previous day's lecture.
- In the last few minutes, we dealt with the Airy disc. The light of stars is formed on the CCD camera according to the formula $\frac{\sin(r)}{r}$, where r is the distance from the centre of the object. Rings appeared around the central peak. The goal is to clean the image from these rings.
- We determined that the height of the first ring is 0.13 if the central peak is 1.0. Thus, this needs to be removed.
- The matrix $\mathbf{A}_{m\times n}$ represents a $m \times n$ greyscale image.
- Each matrix element represents a color in the interval $\{0, \ldots, 1\}$, where 0 is black and 1 is white.
- The matrix $\mathbf{B}_{m\times n}$ represents the background to be removed, with a value of 0.13.
- We are looking for the operation $\mathbf{A} \odot \mathbf{B} = [a_{ij} \odot b_{ij}]$, which removes the parts of the first image that are below 0.13.

Airy disc II

- In formula form: $[a_{ij} \odot b_{ij}] = \begin{cases} a_{ij}, & \text{if } a_{ij} > b_{ij}. \\ 0, & \text{otherwise.} \end{cases}$
- We use the function $x \mapsto \lceil x \rceil$, which rounds up.
- If $a < b$, then $\lceil a - b \rceil$ is 0; otherwise, it is 1.
- Alternatively, $\lceil a - b \rceil$ is 1 if and only if $a > b$, meaning the pixel is above the threshold; otherwise, it is 0.
- Therefore, $a \odot b = a \lceil a - b \rceil$ is the desired operation.

The End

Thank you for your attention!