



Försättsblad Prov Original

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|-------------|------------------------------|---------------------|
| Kurskod | Provkod | Tentamensdatum |
| D T 0 1 0 A | T 1 0 1 | 2 0 1 9 - 0 1 - 0 9 |
| Kursnamn | Datateknik AV, Visualisering | |
| Provnamn | Tentamen | |
| Ort | Sundsvall | |
| Termin | | |
| Ämne | | |

2019-01-09. Examination in DT010A - Visualization, 7.5 hp

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|----------------------|---|
| Allowed aids | Dictionary, non-programmable calculator and drawing tools (e.g ruler) |
| Miscellaneous | Don't forget to: <ol style="list-style-type: none">1. Submit one, or several pages, per solved assignment and NOT several solved assignments per page.2. Order the handed in pages with the solved assignments in ascending order.3. Describe and clearly motivate all solutions, assumptions, programming constructs, etc..4. Attach all neatly drawn figures that you might want to refer to in a solution. <p><u>Failing to follow the above instructions will render point reduction.</u></p> |

Good Luck!

1. Describe two occasions when visualization is NOT useful and when other ways to handle raw data should be considered than through the visualization pipeline. (2 p)
2. Three consecutive processing steps are mainly used to detect objects like cars and people in a video sequence: edge detection, image segmentation, and shape analysis. Describe shortly and concisely how each of these three steps process the intermediate data from the previous step. (3 p)
3. Consider a classical 2D color image, represented as a 2D array of RGB pixel colors stored in an uniform grid. What are the tree main scalar attribute representations and how do they relate to each other in terms of the storage space they require? (3 p)

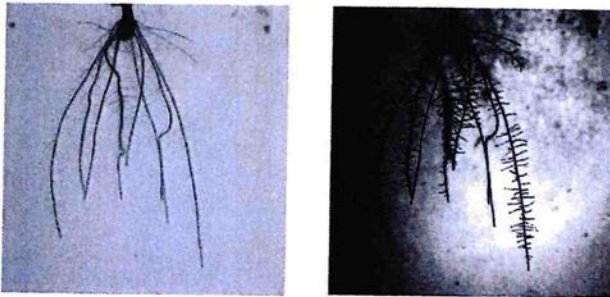
4. Plot the following vector fields using hedgehog glyphs (oriented arrows) for a square domain centered at the origin, spanning the xy -plane (resulting in a 2D plot) with $x = \{-10, -5, 0, 5, 10\}$ and $y = \{-10, -5, 0, 5, 10\}$.

a) $v_1(x, y, z) = (-0.5y, 0.5x, 0)$
b) $v_2(x, y, z) = (3x, 3y, 0)$

(4 p)

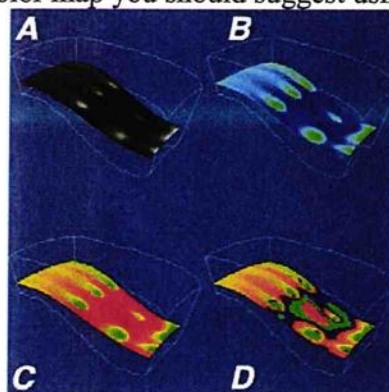
5. The two images below shows the effect of contrast enhancement.

- a) Why is contrast enhancement an often used post-processing step in image visualization?
b) Explain how histogram equalization may be used to contrast enhance an image.



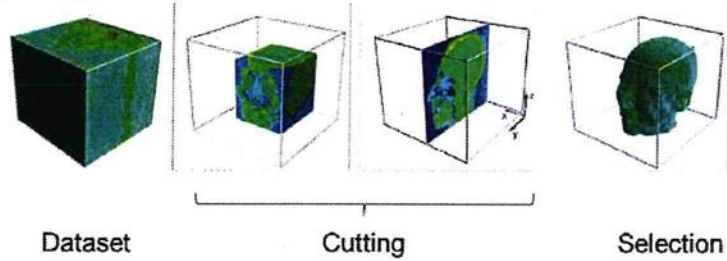
(4 p)

6. Defining a color map is an important part of most visualization methods. The following examples show colormaps used to illustrate a 2D slice in a 3D pressure field inside an engine. Describe which color map you should suggest using and why.



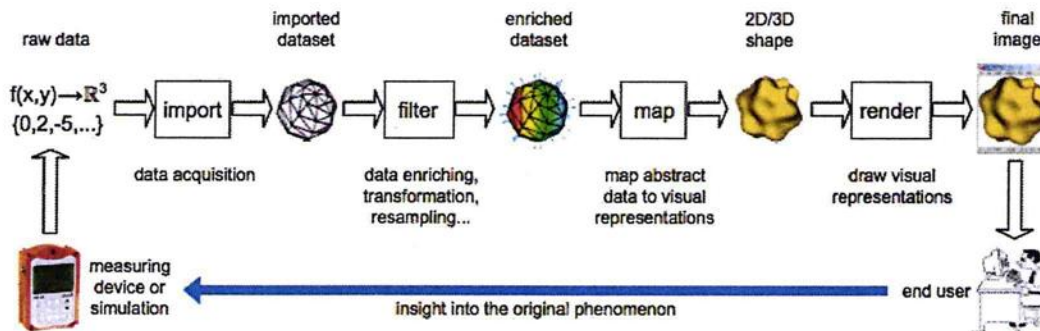
(4 p)

7. Cutting and selection are two different types of domain-modelling techniques, which are illustrated in the figure below. Explain how these two operations process the dataset in order to achieve a resulting output, and give one example where it may be useful to use each technique respectively.



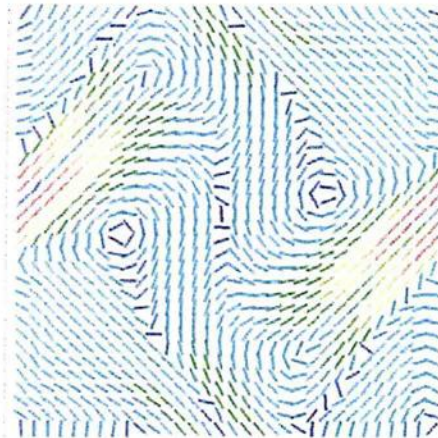
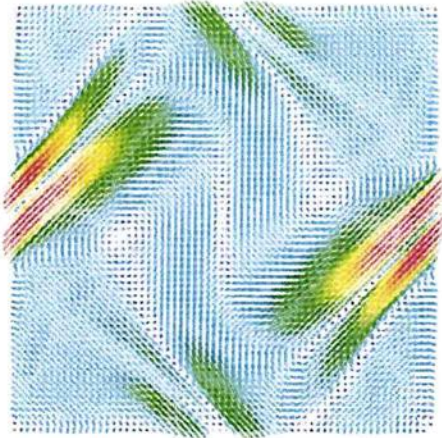
(4 p)

8. The figure below illustrates the visualization pipeline, from raw data to final rendered image and the feedback loop with the end user as a key component. Explain how the dimensionality and size of the data is changed in a general visualization application, when the data passes through each of the four steps.



(5 p)

9. Two types of vector glyphs, as in the figure below, are used to visualize a specific vector field.
- Explain how vector glyphs are created from an underlying vector field.
 - Describe how the two vector glyphs below differ.
 - Elaborate on aspects that you think should be taken into consideration if stream lines were to be used instead of vector glyphs when visualizing a vector field.



(8 p)