Doctor of Engineering (EngD) in Digital Entertainment, 1st Year

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Inverse kinematics

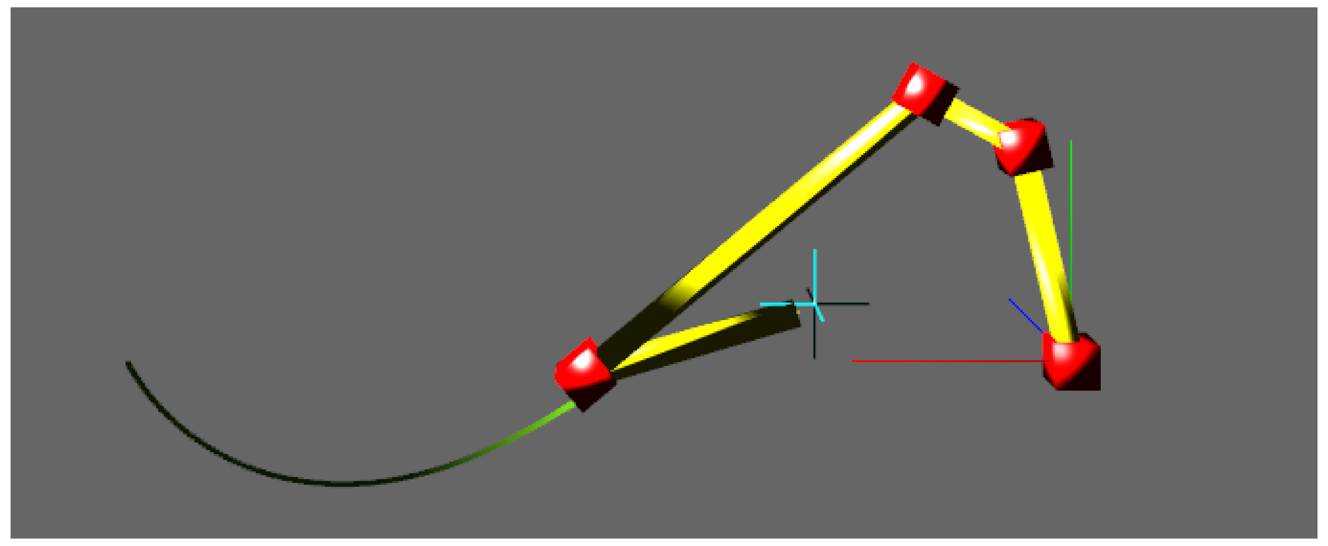


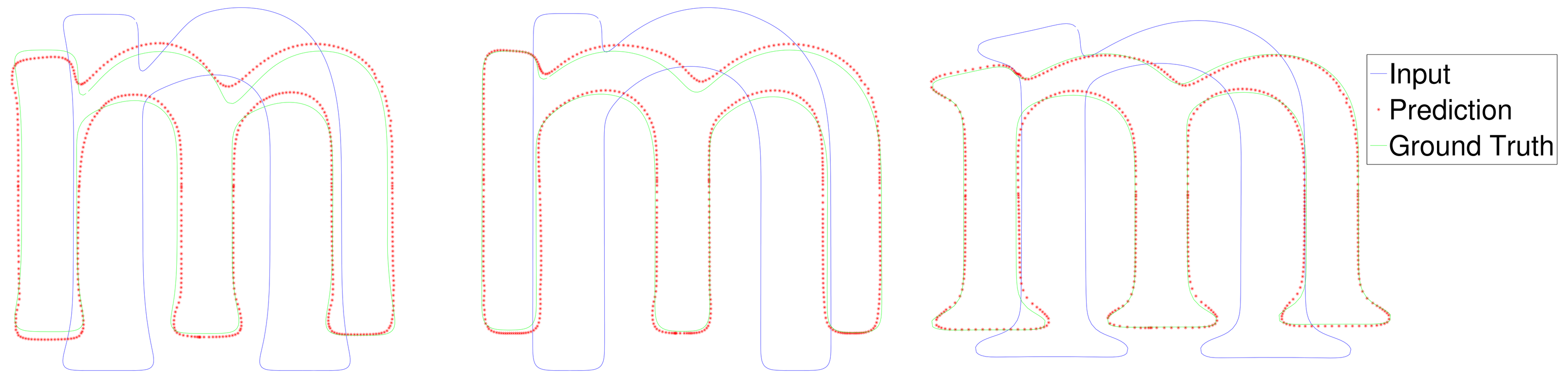
Figure 1: Linkage simulation with trace.

Inverse kinematics uses a known end-effector position $\mathbf{E}$ to calculate the angles between the parts $\boldsymbol{\theta}$ which ensure that the object reaches this desired target position, such that

$$\mathbf{E} = f(\boldsymbol{\theta}) \rightarrow \boldsymbol{\theta} = f^{-1}(\mathbf{E})$$
$$\partial\mathbf{E} \approx J(\boldsymbol{\theta})\partial\boldsymbol{\theta} \rightarrow \partial\boldsymbol{\theta} \approx J^{+}(\partial\mathbf{E}),$$

where f is the forward kinematics solver, J is the Jacobian matrix and $J^{+} = (J^T J)^{-1} J^T$ is the pseudoinverse of J.

Fonts Regression



A Gaussian process is a random process, that can be considered as an infinite-dimensional generalisation of the multivariate Gaussian distribution. The main assumption of the Gaussian process modelling is that our data can be represented as a sample from a multivariate normal distribution. Each time a Gaussian process is used to model some data, a kernel has to be chosen, and its parameters tuned to maximise the likelihood.

Even with very few training examples, the Gaussian process model gives a reasonable prediction of the shape of a font. The best results were achieved using an exponential kernel with an optimised length scale and variance.

SIFT Features

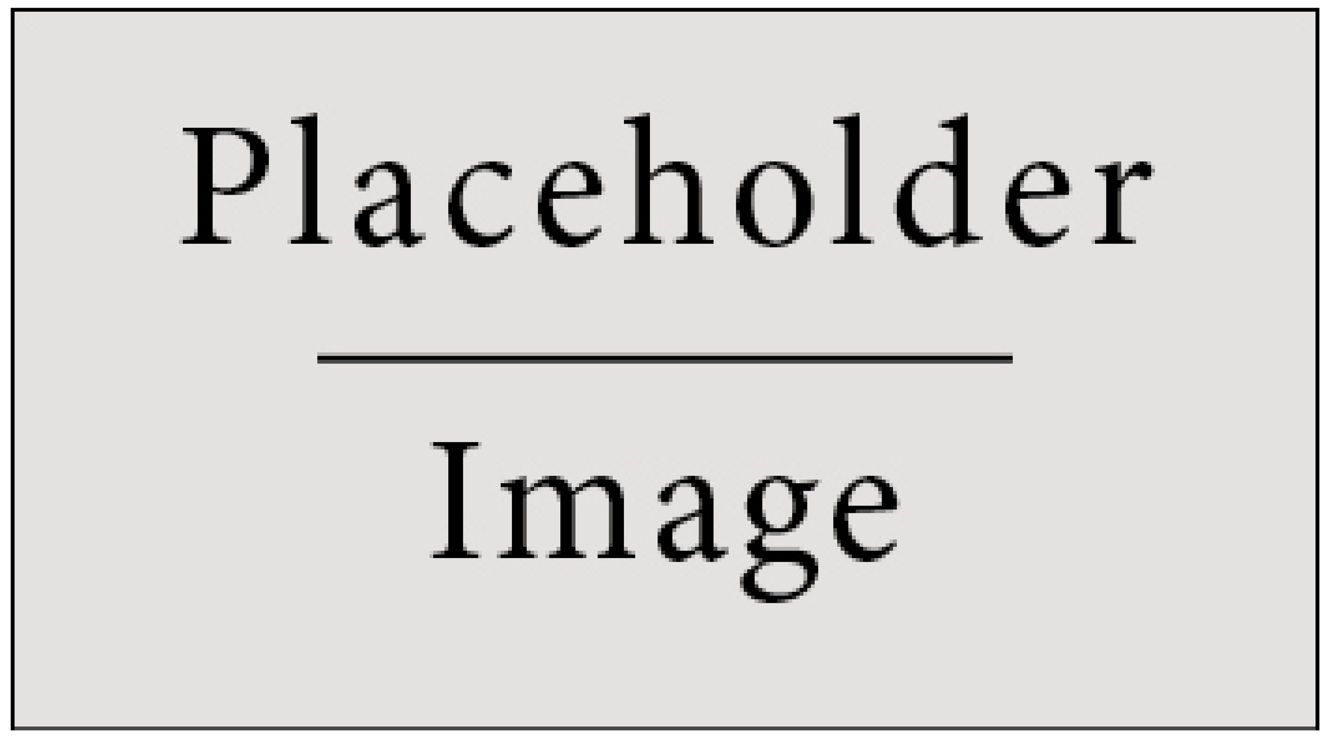


Figure 2: SIFT feature matching.

Being able to detect features in an image that are invariant to scale, rotation, translation and changes in illumination has several applications. SIFT features achieves the scale invariance through extrema detection in a difference of Gaussians pyramid built with the image, while the rotation dealt with an orientation assignment based on local image properties.

Shape interpolation

The following materials were required to complete the research:

- Curabitur pellentesque dignissim
- Eu facilisis est tempus quis
- Duis porta consequat lorem
- Eu facilisis est tempus quis

The following equations were used for statistical analysis:

$$\cos^3\theta = \frac{1}{4}\cos\theta + \frac{3}{4}\cos 3\theta \tag{1}$$

$$E = mc^2 \tag{2}$$

3D Reconstruction

Donec faucibus purus at tortor egestas eu fermentum dolor facilisis. Maecenas tempor dui eu neque fringilla rutrum. Mauris *lobortis* nisl accumsan.

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table 1: Table caption

Nulla ut porttitor enim. Suspendisse venenatis dui eget eros gravida tempor. Mauris feugiat elit et augue placerat ultrices. Morbi accumsan enim nec tortor consectetur non commodo.

Visual Understanding 2

- Pellentesque eget orci eros. Fusce ultricies, tellus et pellentesque fringilla, ante massa luctus libero, quis tristique purus urna nec nibh. Phasellus fermentum rutrum elementum. Nam quis justo lectus.
- Vestibulum sem ante, hendrerit a gravida ac, blandit quis magna.
- Donec sem metus, facilisis at condimentum eget, vehicula ut massa. Morbi consequat, diam sed convallis tincidunt, arcu nunc.
- Nunc at convallis urna. isus ante. Pellentesque condimentum dui. Etiam sagittis purus non tellus tempor volutpat. Donec et dui non massa tristique adipiscing.

References

[1] J. M. Smith and A. B. Jones. *Book Title*. Publisher, 7th edition, 2012.

[2] A. B. Jones and J. M. Smith. Article Title. *Journal title*, 13(52):123–456, March 2013.

Future Research

Integer sed lectus vel mauris euismod suscipit. Praesent a est a est ultricies pellentesque. Donec tincidunt, nunc in feugiat varius, lectus lectus auctor lorem, egestas molestie risus erat ut nibh.

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