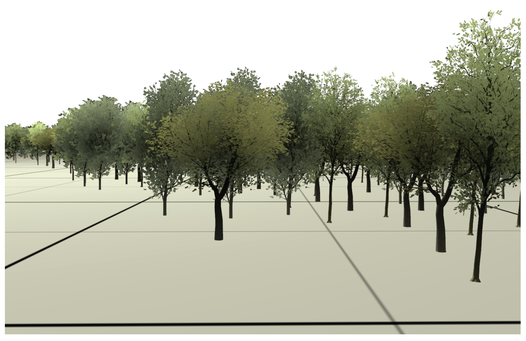
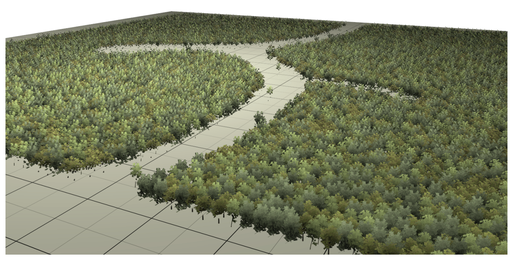
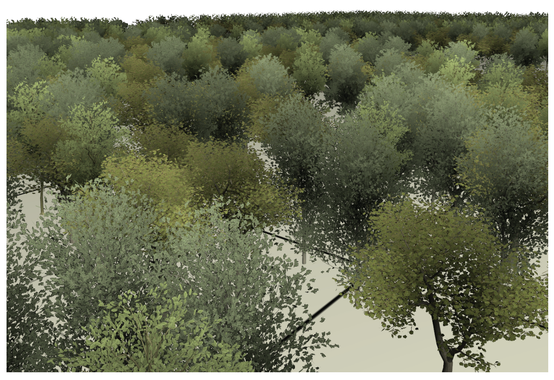
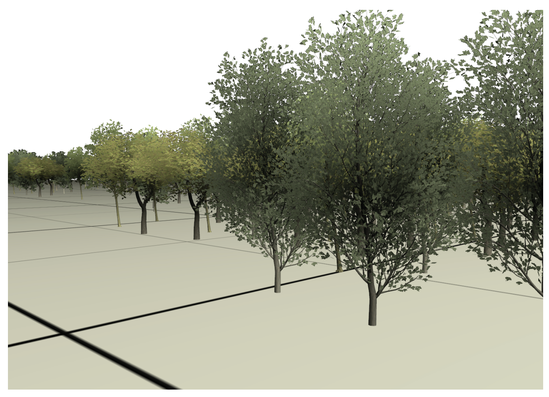
Karlsruhe Institute of Technology

graphics.uni-konstanz.de

Precision and Recall as Appearance Space Quality Measure for Simplified Aggregate Details

Boris Neubert, Sören Pirk, Oliver Deussen, Carsten Dachsbacher

Precision and Recall

true positives are pixels that are correctly set, i.e. rendered for the original and for the simplified model.

false positives are pixels that are wrongly set, i.e. rendered only for the simplified model.

false negatives are pixels that are rendered for the original model, but not covered by the simplified one.

Original Model | Simplified Model (40 % Geometry + Scaled (25x)) | Wrongly Set Pixels | PR Scores | Optimal Pruning Parameters

Widely applied in the domain of information retrieval.

Well-known statistical classifications or measures for exactness and completeness.

Closely related to sensitivity and specifity to measure the performance of binary classification algorithms, such as support vector machines and Bayesian networks.

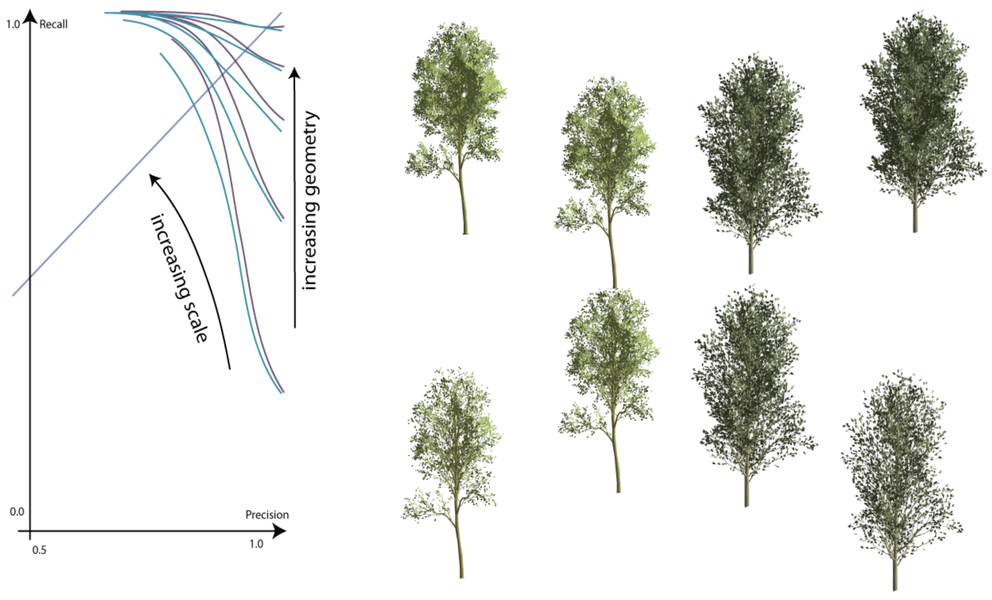
$$\textbf{Precision} = \frac{\text{relevant items} \cap \text{retrieved items}}{\text{retrieved items}} = \frac{\mathbf{tp}}{\mathbf{tp + fp}}$$

$$\textbf{Recall} = \frac{\text{relevant items} \cap \text{retrieved items}}{\text{relevant items}} = \frac{\mathbf{tp}}{\mathbf{tp + fn}}$$

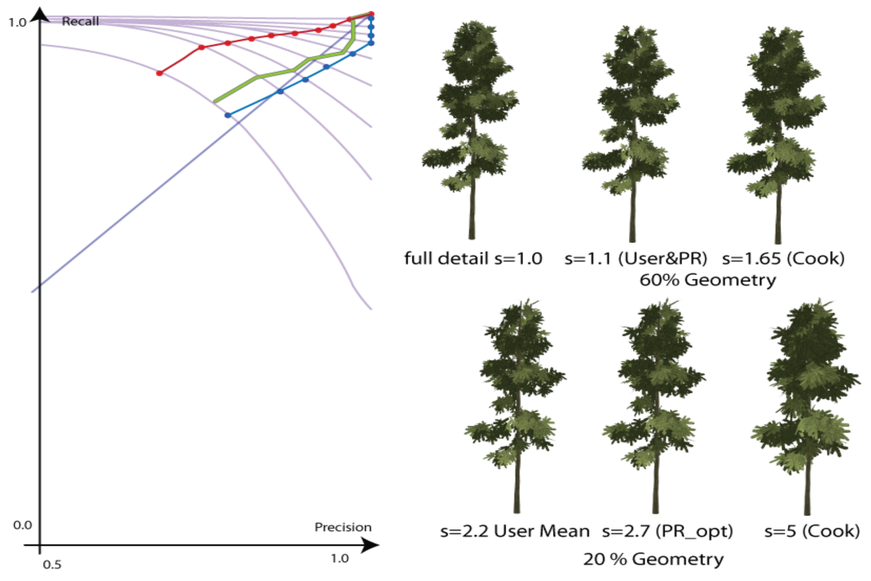
Recall is the quotient of correctly identified items (true positives) and all relevant items (sum of true positives and false negatives). Translated into this scenario: the ratio of correctly set pixels and the number of correctly set pixels plus the number of pixels that should have been rendered, but which are not covered by the pruned model.

Precision is defined as the ratio of correctly identified items (true positives) and all returned (sum of true positives and false positives). Here, when rendering a pruned model it is the ratio of pixels that are correctly set, i.e. they would have been rendered for the full-detail model as well, and the total number of set pixels.

Optimized Aggregate Details



The Precision-Recall diagram for different plant models for five different geometry levels l and varying scaling values. An interesting case is for example is the Ulmus model (right): it does not benefit from scaling for higher l-values, and scaling even lowers the PR-score.



Comparision between different scale values. Red: scale value according to Cook et al. [CHPR07] s = 1=l. Green: user-preferred scale value (median). Blue: optimal scaling value found using PR scores. Scaling does not improve the PR-scores for this model when more than 60% of the original geometry is rendered. This is also reflected in the preferred scaling values obtained from the user study.