In this paper, we propose a methodology to automatically evaluate the stability of text localization systems via metamorphic relations, where a stable system should output consistent results for similar inputs with the same text segments. We introduce six metamorphic relations that should be preserved in a stable text localization system and define the corresponding metrics for stability evaluation. With the defined metamorphic relations, we apply metamorphic testing techniques to compare the inputs and outputs to evaluate system stability, and further diagnose the causes of inconsistency. The extensive experimentation on both academic and commercial text localization systems demonstrates the effectiveness of our method on stability evaluation for such systems.

Abstract

Overview

Concepts

Text localization systems

Metamorphic relations

Increasing brightness (MRb_i)

Decreasing brightness (MRb_d)

Channel switch (MRc)

Perspective transformation (MRp)

Watermarking (MRw)

Masking (MRm)

Stability evaluation

The Consistency on dataset between follow-up and source with its MR.

Experimentation

• Effectiveness of stability evaluation on text localization tools

• Redundancy of metamorphic relations

• Usability of evaluation results

Conclusion

• We have proposed a methodology to evaluate the stability of text localization systems with metamorphic testing techniques.

• We have introduced six MRs w.r.t. the properties of text localization systems and the feature of their inputs. Follow-up can be generated automatically and compared with the source according to the defined metamorphic relations.

• The extensive experimentation on both academic and commercial text localization tools reveals many inconsistent outputs, and demonstrates that the methodology is effective in shooting both the advantages and disadvantages of such systems, and evaluating system stability.

• We have also investigated various image evaluation metrics to analyze the relation between the features of the 29 images and the stability of tools, which can be applied as heuristics for further diagnosis and improvement.

Data Synthesis

Text localization system

Follow-up Test Set

Follow-up Results

Result Analysis

Stability Evaluation

Testing results

Follow-up Test Set

Using metamorphic relations

Using metamorphic relations

Follow-up Test Set

Follow-up Test Set

Follow-up Test Set

Follow-up Test Set