Label Assistant: A Workflow for Assisted Data Annotation in Image Segmentation Tasks

31st Workshop Computational Intelligence, Berlin

M. P. Schilling, L. Rettenberger, F. Münke, H. Cui, A. A. Popova, P. A. Levkin, R. Mikut, M. Reischl | 26th November 2021
Outline

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2 Workflow
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Introduction - Labeling

Input images $x$

Deep Neural Network

Objective

Labels $y$

Human annotator

Introduction

Workflow

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Introduction - Labeling

Deep Neural Network

Objective

Input images $x$

Labeling

Human annotator

Labels $y$
Introduction - Challenges

→ **Objective:** Workflow for assistance to enhance labeling process [1, 2]
Workflow

Unlabeled dataset $D^u$  
Selector  
Pre-Assistance  
Human annotator  
Post-Assistance  
Labeled dataset $D^l$
Selector

Status Quo

Labeling Order

→ Sequential sampling can be sub-optimal

Selector (Deep Active Learning)

Feature 2

Uncertainty

Feature 1

→ Use selection strategy (uncertainty, heterogeneity, ...)

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Pre-Assistance

Image Pre-Processing

Pre-Labeling

→ Prepare image to simply labeling for annotators

→ Pre-Labels to reduce labeling effort

Wrong segments

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Post-Assistance

Post-Processing to improve label quality

Label Inspection

User warning based on defined criteria to enhance label quality
Implementation

Available soon (Git repository https://git.scc.kit.edu/sc1357/kaida)

Support of different devices (tablet, laptop)/operating systems
Datasets

Sample

Mask

Medaka [4]

Sample

Mask

DMA Spheroid [5]
- Performance comparison: Different selection strategies to obtain labeled subset in contrast to labeling complete dataset (baseline)

| Configurations |
|----------------|
| Sequential     | Random | Sequence-aware | Baseline |
| $|D_{\text{train}}^i|$ | 32     | 32             | 32       | 400     |
| $DSC_{\text{test}}$ in % | 46.50 | 77.67          | 80.63    | 82.70   |

- Pre-Labeling via trained U-Net [6] on small dataset

1 Selection of one random sample per sequence
Result excerpts - DMA Spheroid

- Image Pre-Processing

- Pre-Labeling via Otsu thresholding

80.18 %

| Introduction | Workflow | Implementation | Datasets | Results | Conclusion and Outlook |
|--------------|----------|----------------|----------|---------|------------------------|
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Conclusion and Outlook

**Conclusion**

- Presentation of a generic workflow combing and extending various ideas of labeling enhancement
- Template for community usage in deep learning projects
- Software prototype which implements proposed workflow

**Outlook**

- Extension of methods depicted in each assistance module
- Integration of other tasks (e.g. classification) in Label Assistant
- Open-source deployment of software prototype as pip package for community usage

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2 Git repository [https://git.scc.kit.edu/sc1357/kaida](https://git.scc.kit.edu/sc1357/kaida)
Many thanks for your attention!
References

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