Computer Vision applied to Dengue's Larvae Death Rate Calculation
Preliminary Results

SOUZA, K. P.; QUEIROZ, J. H. F. S; PISTORI, H.

Introduction

Main task

- Development of more effective larvicides to combat Dengue’s transmitter mosquito.

Requirements

- Many experiments with different substances
- Lab tests, such as larvae death rate (human task)

Problem

- Errors due to human limitations during analysis can reduce results quality (e.g. exhaustion, subjectivity, and inaccuracy)

Proposal

- LARVIC: Computer vision application for larvae counting

Methodology

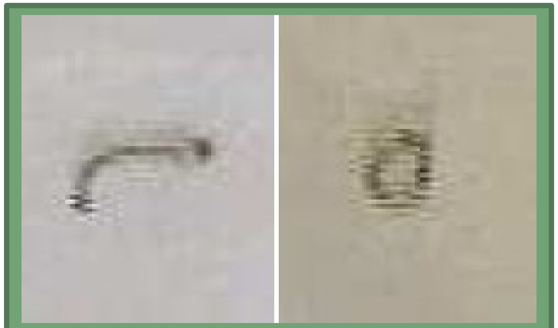
- Fixed camera positioned above recipients with larvae
- Image sequences are captured and then processed by a computer vision application to classify larvae into two classes: death or alive.

Work features

- Single recipient with only one larva
- Techniques: HMM, HMM+ML, ML
- One token extracted from each frame

- Segmentation: background subtraction, machine learning and semi-automatic
- Feature extraction: Hu Moments, K-Curvature Histogram, Shape Features (aspect ratio, form factor, roundness, compactness)
- Classification: C4.5, KNN, SVM and MLP (weka)

Stretched



Curved

Experiments

- Three image sequences of 1300 frames
- Dead larva: 2 sequences
- Live larva: 1 sequence

- Small shots extracted from sequences (~100 frames each)
- Dead larva: 24 shots
- Live larva: 10 shot

- Training set: 2/3 of shots
- Testing set: 1/3 of shots
- Analysis metrics: Hit rate and AUC

Experiments and results

Strategy	Hit Rate(%)	AUC
Random	59%	0.625
Pre-comp. manually	82%	0.8292
Pre-comp. automat. - 2 states	88%	0.7917
Pre-comp. automat. - 3 states	91%	0.7875
Pre-comp. automat. - 4 states	88%	0.7875

Experiments and results

Stopping Criteria

- Three different strategies to define the number of iterations for HMM training
- 1) No increase happens, 2) difference is under a threshold and 3) fixed number of iterations.

Random

- Strategy 1: No increase happens: 12% higher using random probabilities
- Strategies 2 and 3: no changes

Pré-computed manually

- Strategy 1: No changes
- Strategies 2 and 3: increases from 3 to 12%

Pré-computed automatically

- No gain

Experiments and results

HMM+ML

- No gain using the best initialization and stopping criteria found in previous experiments

Only ML

- Algorithms: IBK, J48, SVM, and MLP
- Fixed number of features
- Three sets of features: token counting (2 features), changes between tokens (4 features) and general token changes counting (1 feature).
- Best results (Maximum AUC of 0.97)

Conclusions

- Pre-computed initial probabilities obtained better results than random probabilities.
- Manually (onerous) and automatically pre-computed initial probabilities obtained close results.
- Considering computational cost, low fixed number of iterations was appropriate for training in this application.
- No improving detected with combined classifiers.
- HMM performance was lower than some “vector features” classifiers performances.

Future work

- Analysis of larger sets of different samples of live and dead larvae
- Use of other algorithms for training HMM’s
- Analysis of classifiers based on machine learning algorithms with different patterns

Agradecimentos

- UCDB
- FUNDECT
- CNPQ
- CAPES
- CPP

MAIS INFORMAÇÕES: www.gpec.ucdb.br/inovisao