Landmarks Detection by Applying Deep Networks

Van-Linh LE[1,3], Marie BEURTON-AIMAR[1],
Akka ZEMMARI[1], Nicolas PARISEY[2]

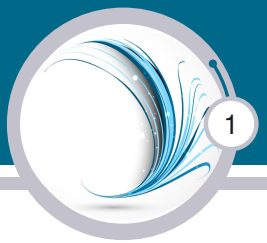
linhlv@dlu.edu.vn/van-linh.le@labri.fr, beurton@labri.fr
akka.zemmari@labri.fr, nicolas.parisey@inra.fr

[1]LaBRI-CNRS 5800, Bordeaux University, France
[2]IGEPP, INRA 1349 Rennes, France
[3]ITDLU, Dalat University, Vietnam

MAPR Conference

Ho Chi Minh City, 5-6 April, 2018

Context



Morphometry analysis

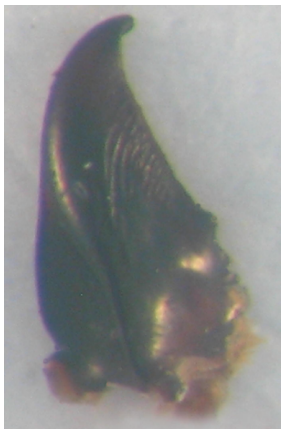
- Used to study the complex interaction between the evolution of insect and environmental factors.
- Characterize the common information of biological shape, such as, shape, sizes, or **landmarks**,. . . .

Landmark

- A kind of **point of interest**
- A specific point defined by biologist. For example, intersection of viens on fly wing, the tip of beetle's mandible,. . .

Dataset

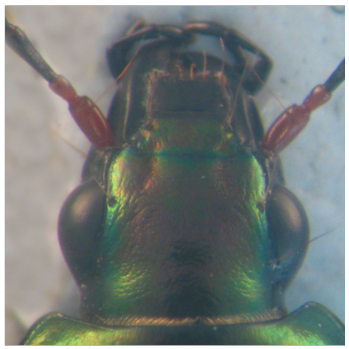
- Images have been taken from 293 **beetles**, seperate into 5 parts (images),
- Format: 2D in RGB color,
- Focus on **pronotum** images.



(a) Left mandible

(b) Right mandible

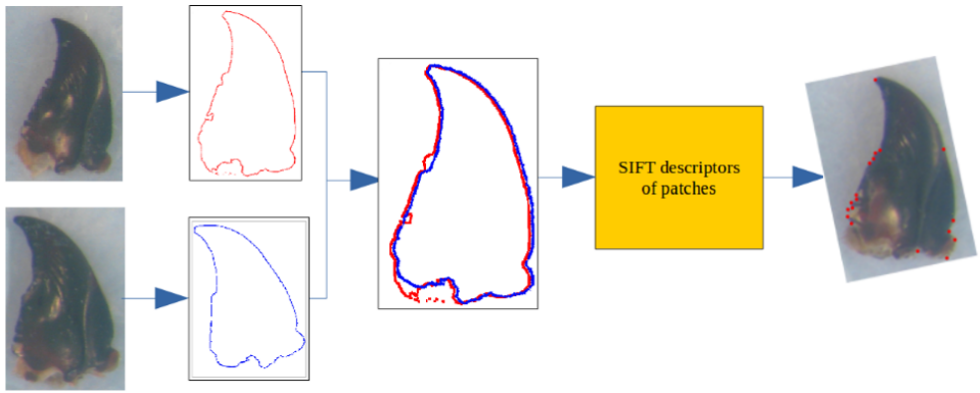
(c) Body



(d) Head

Problems

With segmentable images:[1]



[1] Van-Linh Le, Marie Beurton-Aimar, Adrien Krähenbühl, and Nicolas Parisey. “MAELab: a framework to automatize landmark estimation." WSCG 2017.

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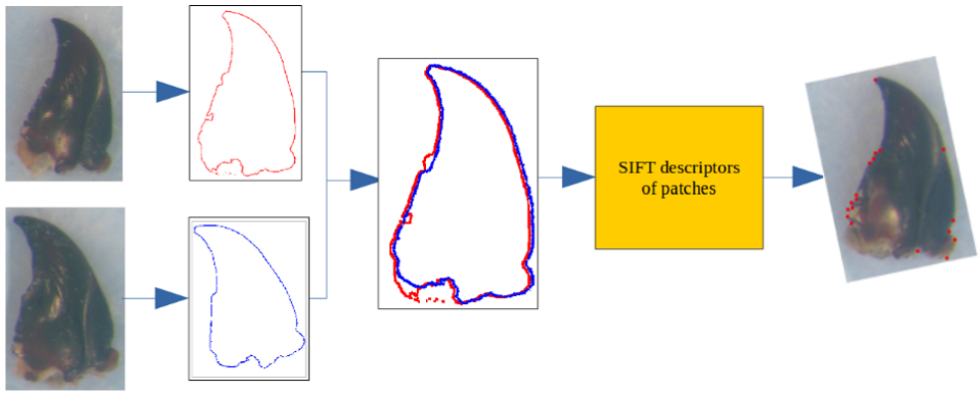
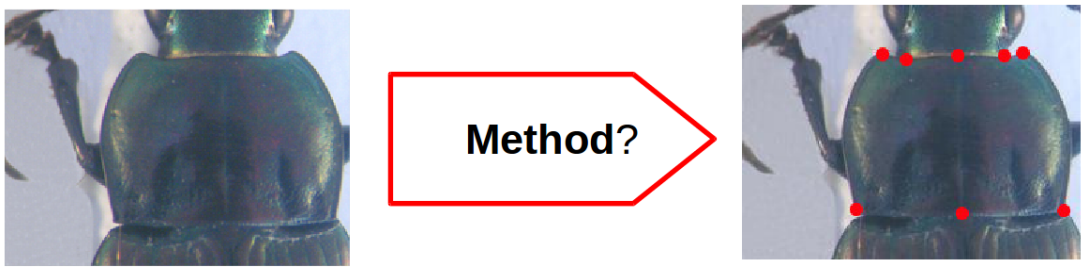


With un-segmentable images:



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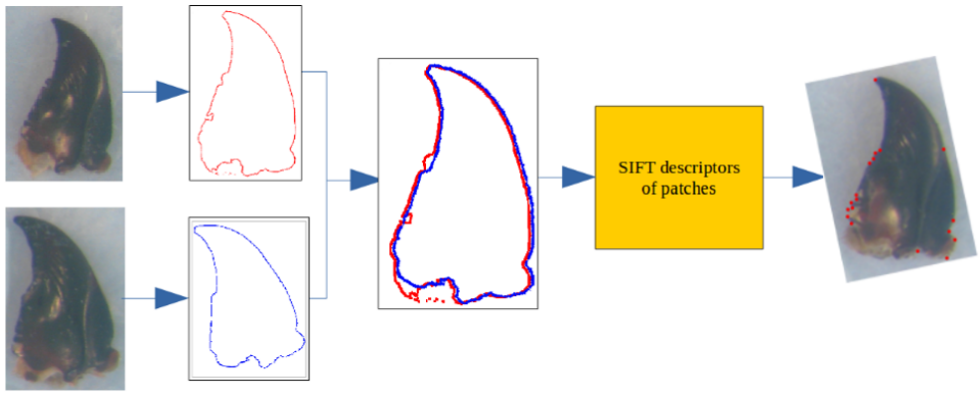

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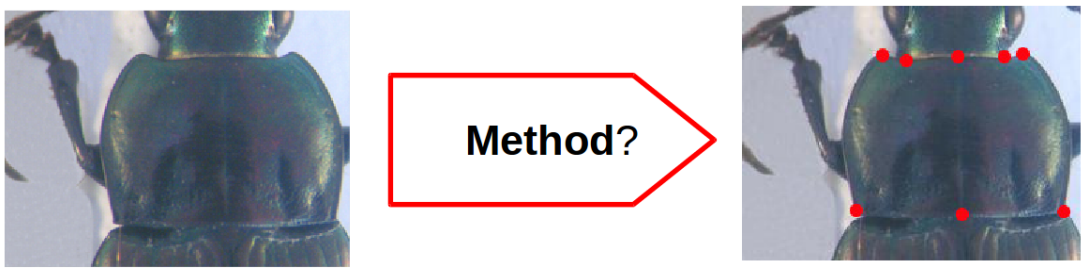

How to predict the landmarks coordinates?

[1] Van-Linh Le, Marie Beurton-Aimar, Adrien Krähenbühl, and Nicolas Parisey. “MAELab: a framework to automatize landmark estimation." WSCG 2017.

Content

Deep learning

Definition

- A class of machine learning,
- Use a cascade of multiple layers for feature extraction and transformation,
- Learn multiple levels of representation in supervised or unsupervised.

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Applications

- Computer vision (image recognition and classification)
- Speech recognition
- Question answering [], language translation[]

CNNs

- Consists an input, an output and multiple hidden layers
- Arranges the data in 3 dimensions: *width, height and depth*
- Classical layers: convolutional layers (**CONV**), pooling layers (**POOLING**), dropout layers (**DROPOUT**), full-connected layers (**FC**), . . .

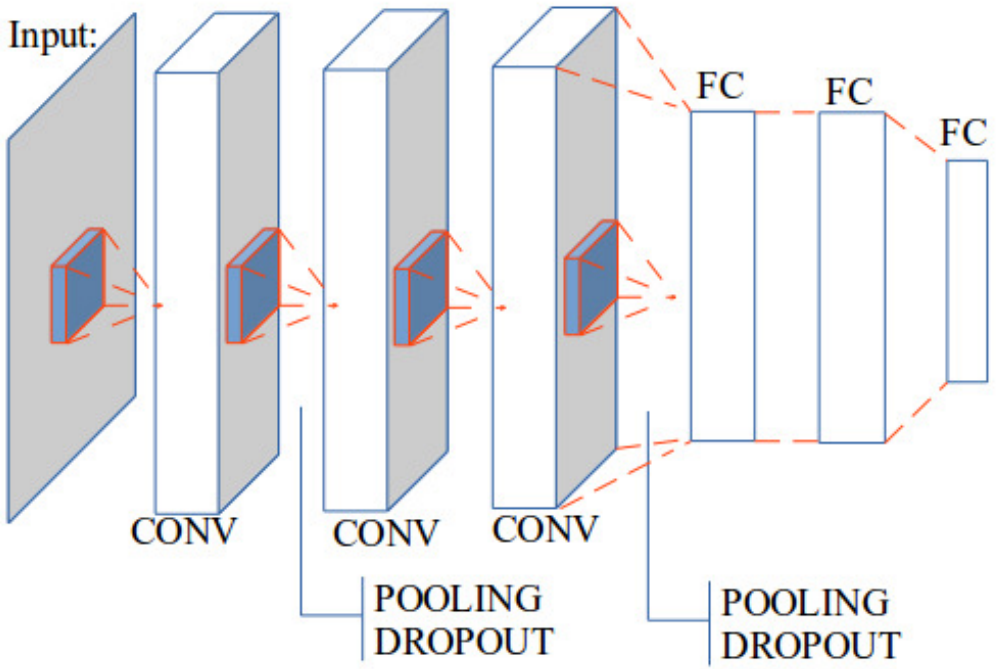


Figure: An example of CNN

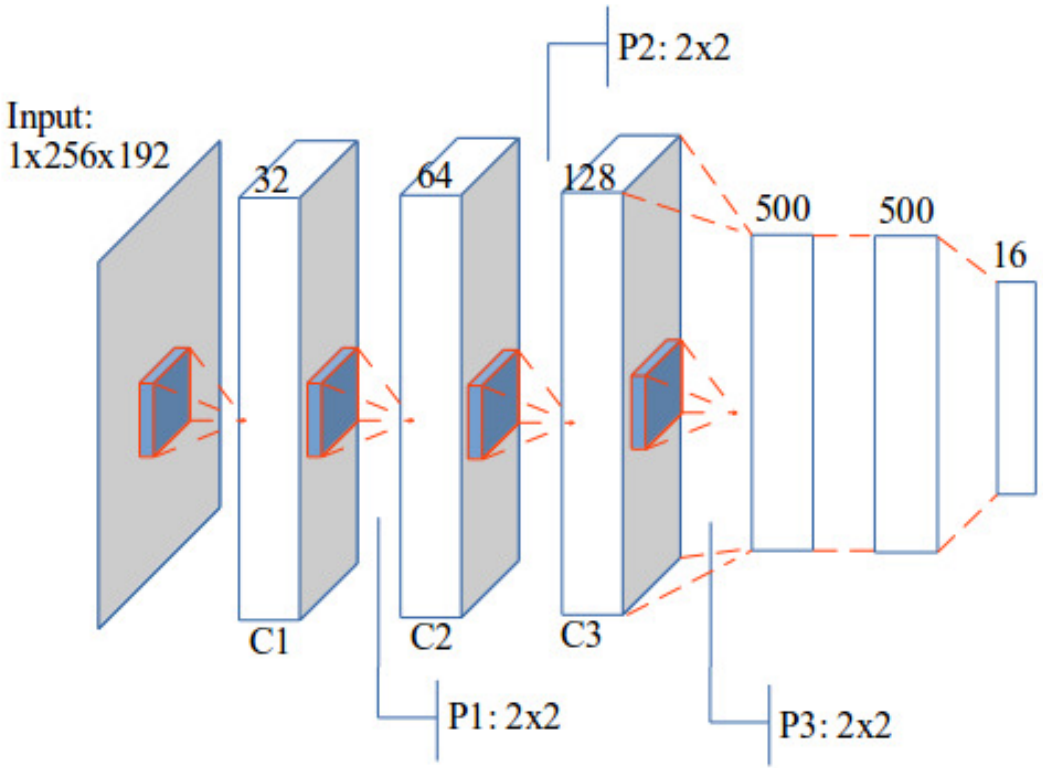
Proposed method
Network architecture

The first model includes:

- An gray-scale input,
- 3 CNN layers,
- 3 POOLING layers,
- 3 FC layers.

Problems:

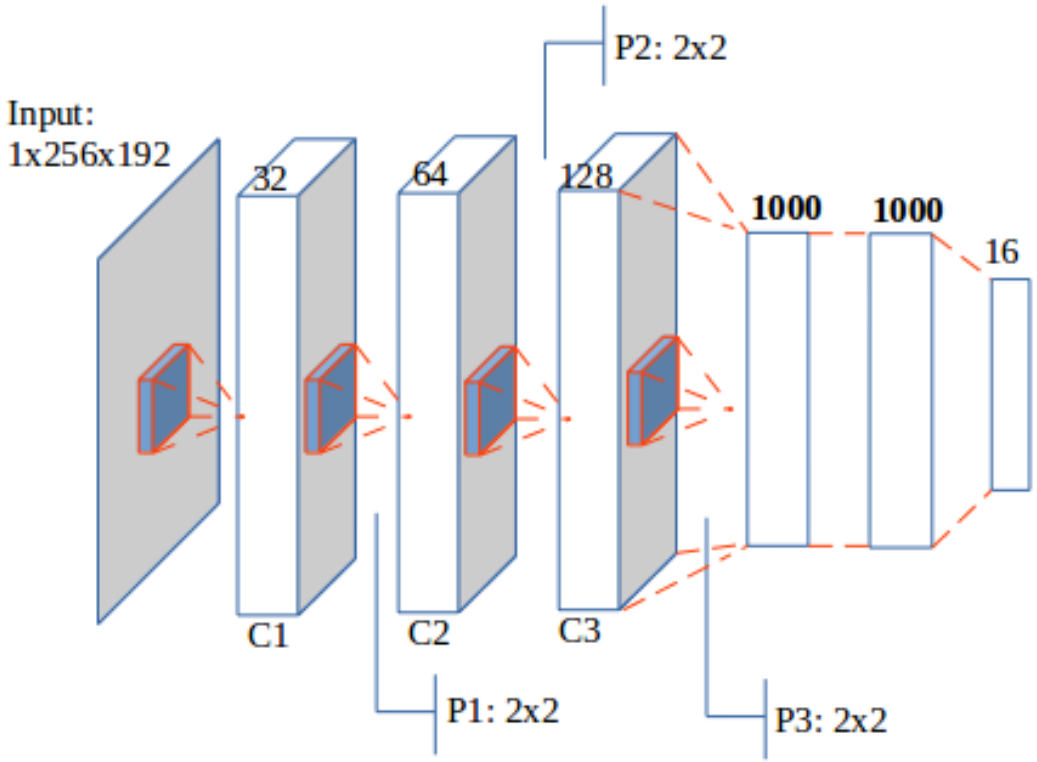
- Output is not good enough,
- Overfitting.



Proposed method
Network architecture

The second model:

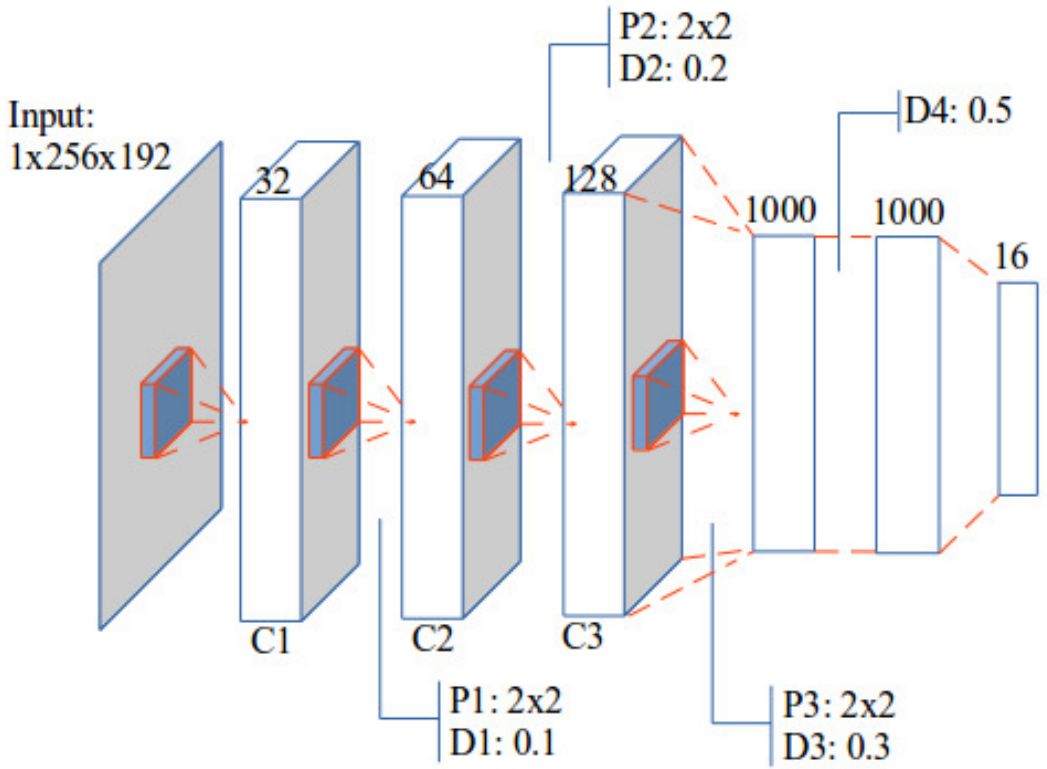
- Has the same architecture with the first one,
- Modify the output of FC layers,
- Result is not improved.



Proposed method
Network architecture

The **third** model includes:

- An gray-scale input,
- 3 CNN layers,
- 3 POOLING layers,
- 4 **DROPOUT layers,**
- 3 FC layers.



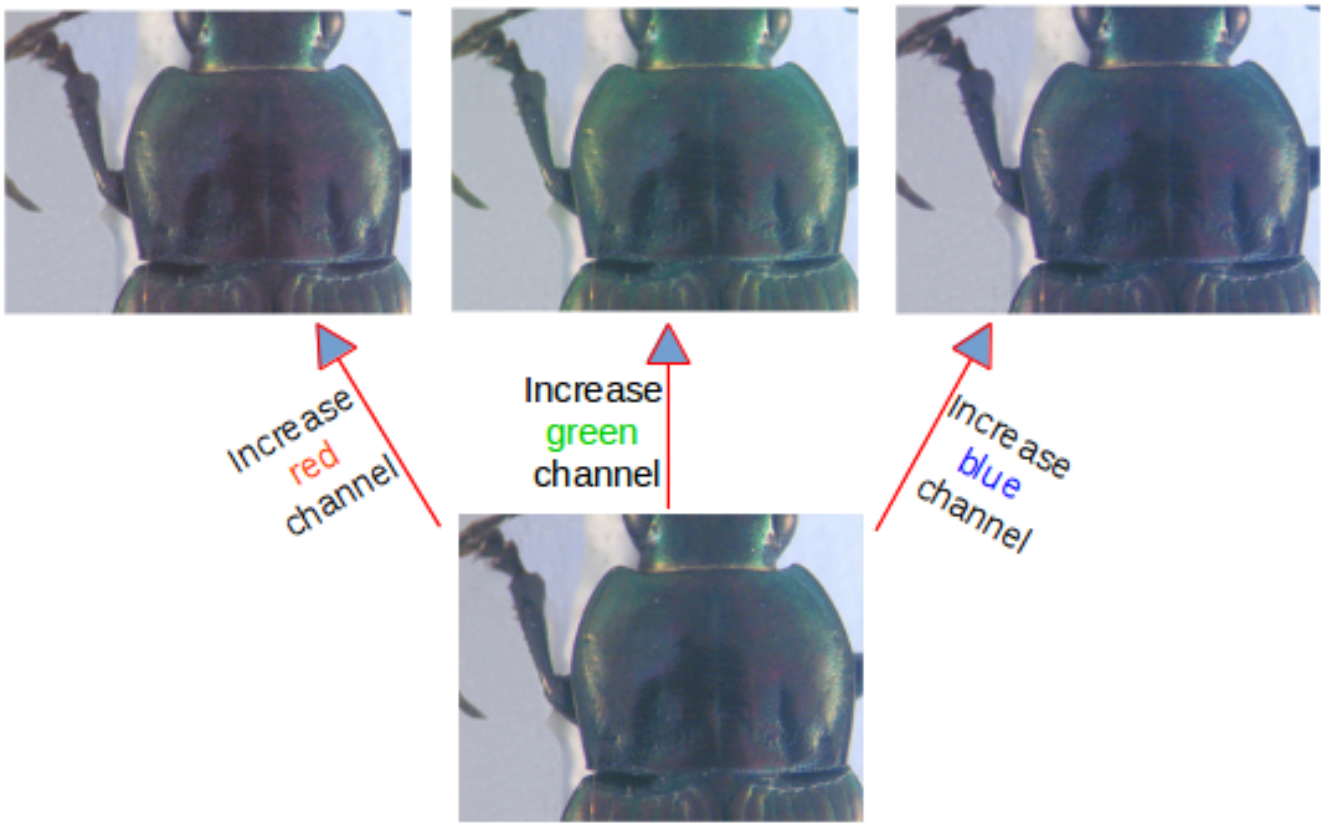
Proposed method
Data augmentation

Dataset: 293 pronotum images in RGB format.

Proposed method
Data augmentation

Augmentation methods:

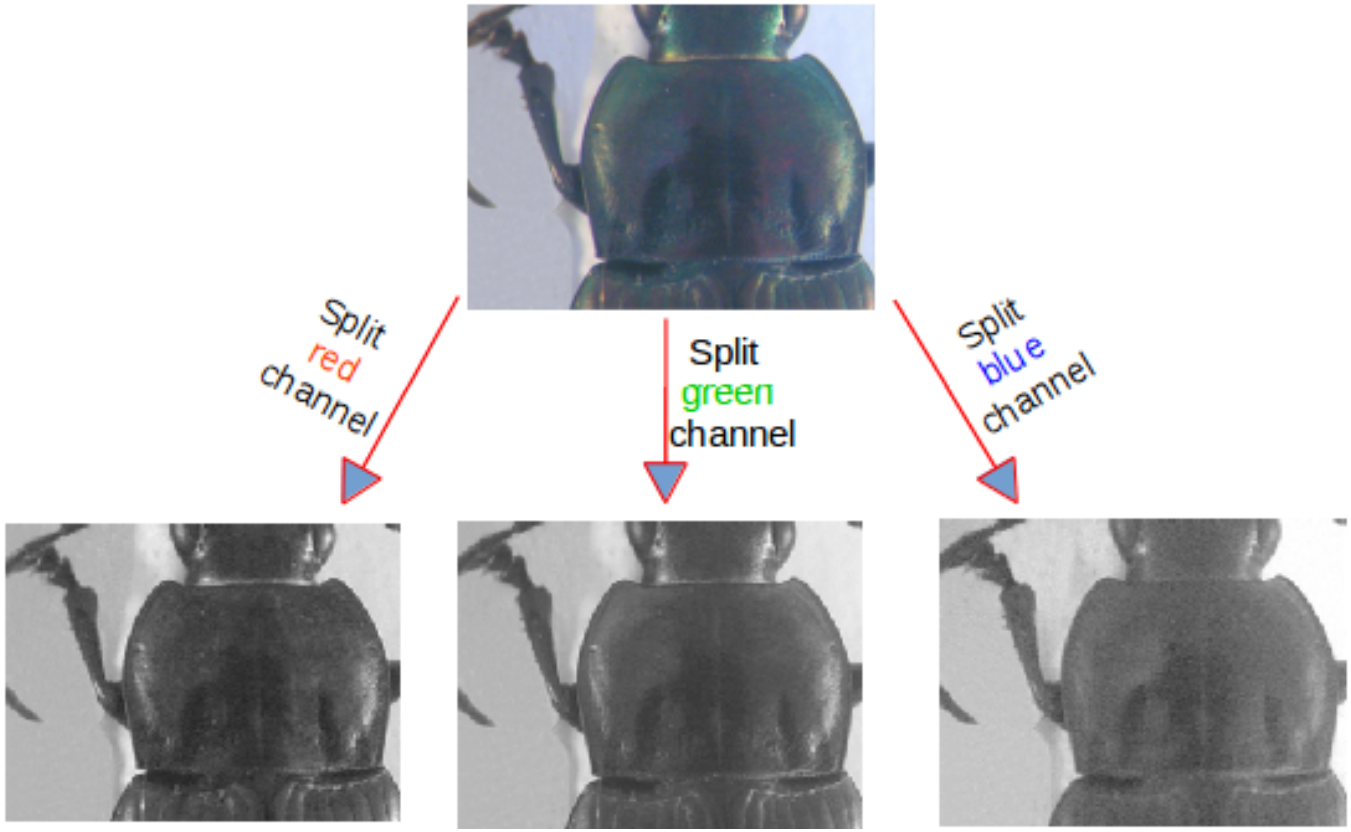
- Increase the value of each channel,



Proposed method
Data augmentation

Augmentation methods:

- Split the channels.

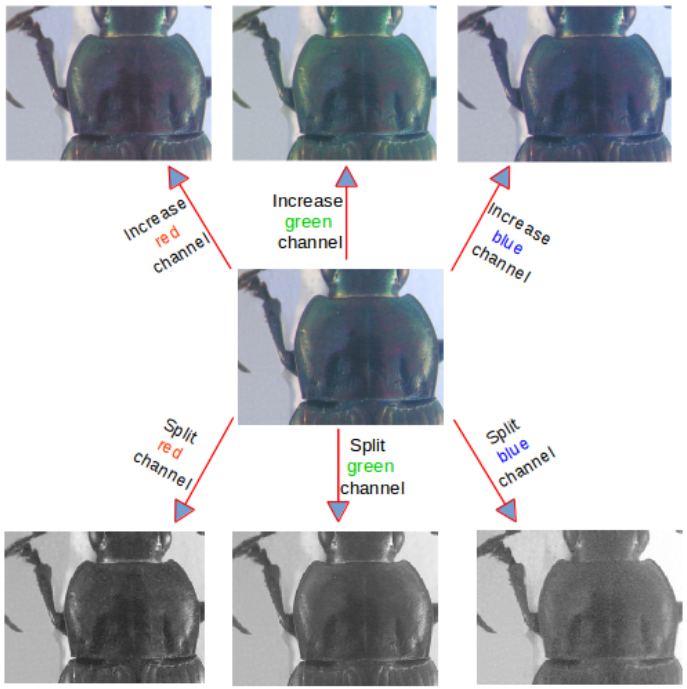


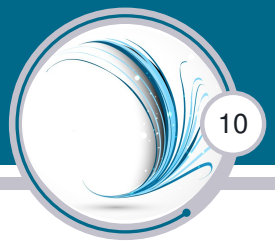
Proposed method
Data augmentation

Dataset: 293 pronotum images in RGB format.
Augmentation methods:

- Increase the value of each channel,
- Split the channels.

Total: $293 \times 7 = 2051$ images





The Feather Background Image

- In Feather theme, the title page frame and the last frame have the Feather image as the background image.
- The Feather background image can be produced to any frame by wrating on the begining at the choosen frame the following

```
{\1bg
\begin{frame}[<options>]{Frame Title}{Frame Subtitle}
...
\end{frame}}
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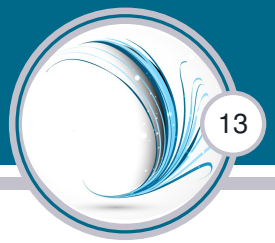

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Thank you for using Feather Beamer Theme!