

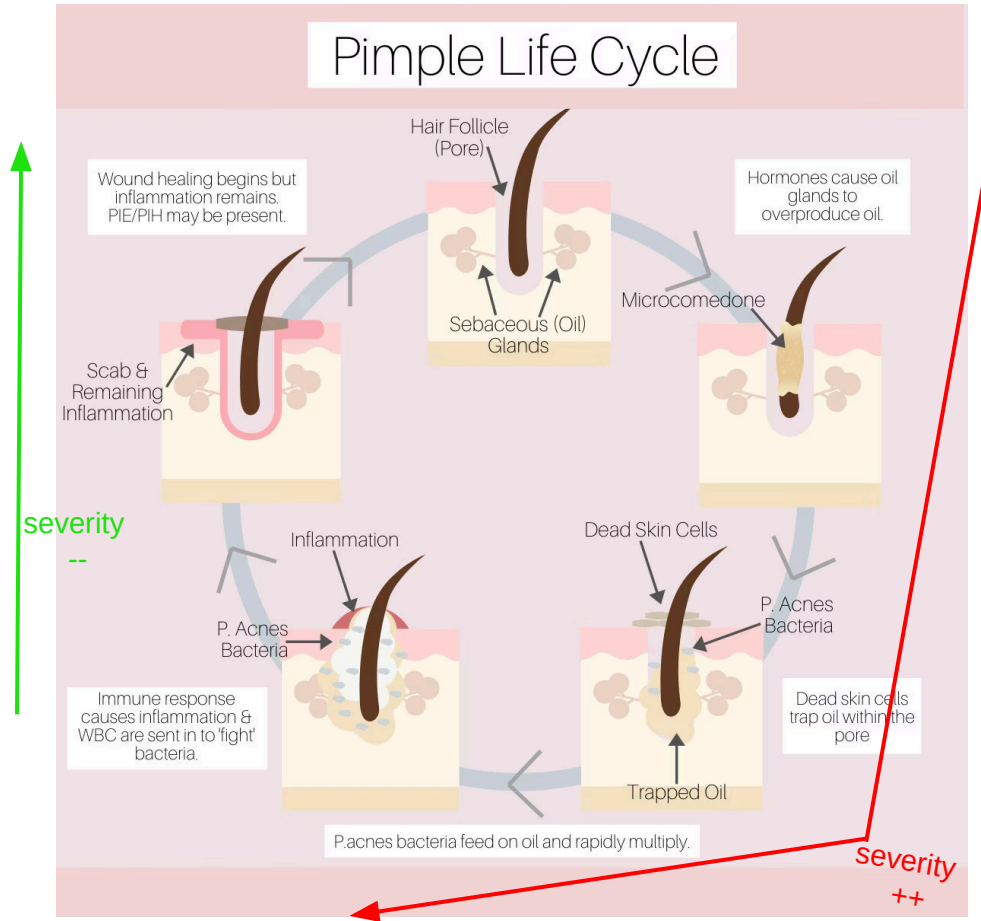


Acne AI : new classification system

last update : 11 June 2024

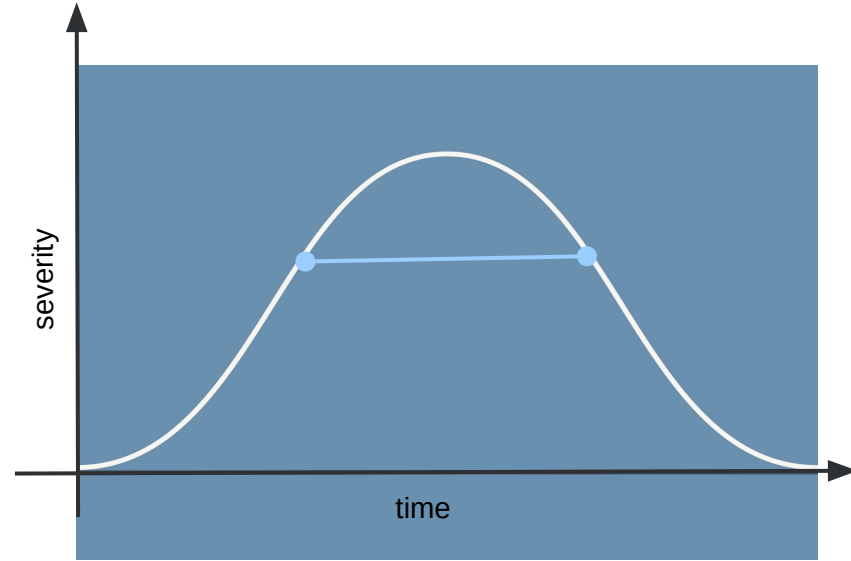
Context

- Typically a pimple will last from 3-6 weeks, depending how severe it gets.
- here are the different stages of an acne lesion (not mandatory to go through all the stages)
- During this period, the severity will increase until it reaches the top, and then decrease until the lesion disappears (or becomes a scar)



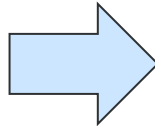
Context

- So, the curve of acne severity of a pimple over time looks like this :
- The type (papule, comedo, etc) of acne depends on the stage of the pimple
- Visually, it can be hard to know in which stage of the pimple we are, because the severity may be the same, but can be either in the ascent (= getting worse) , or in the descent (= getting better) of the curve.



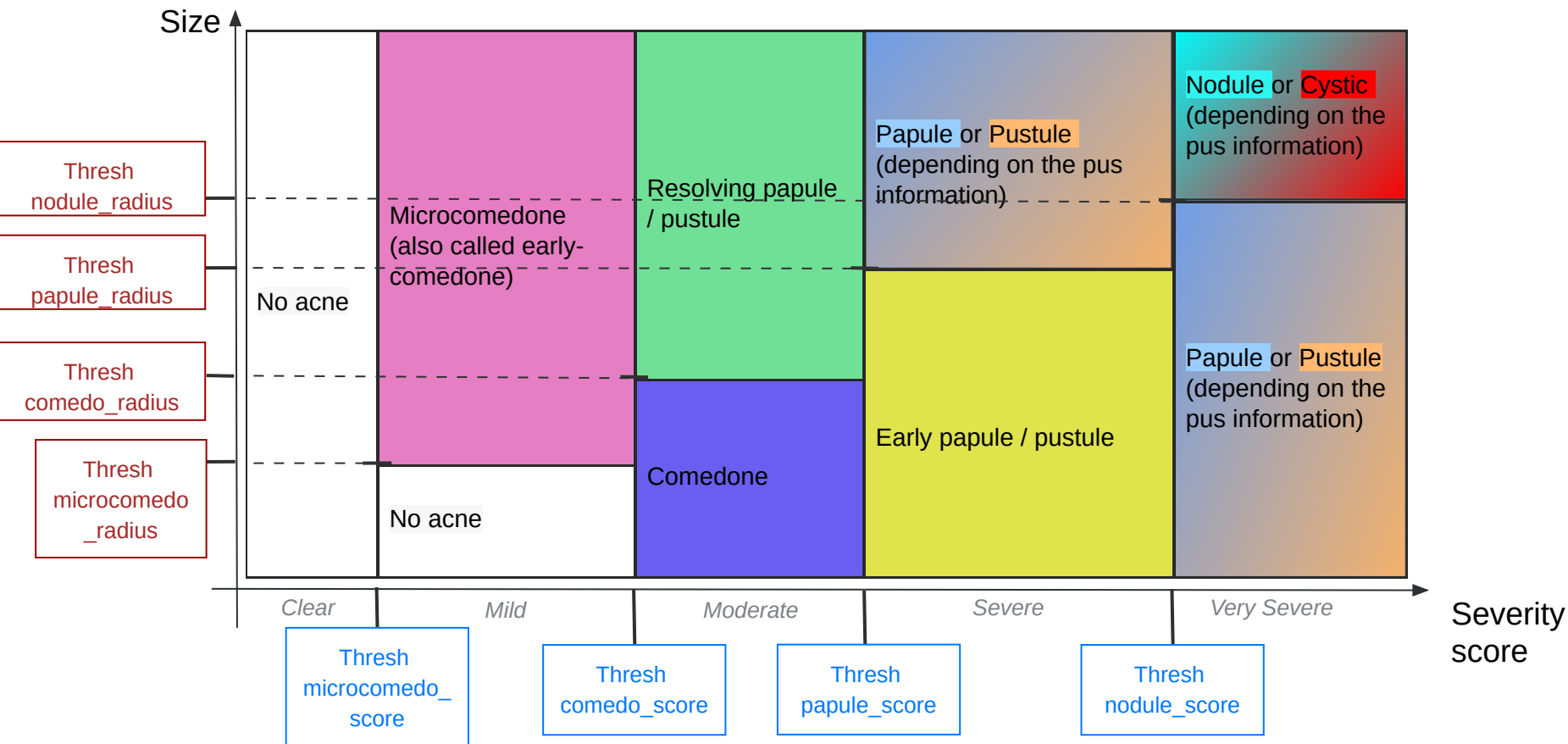
Classification and acne types

- Based on the prediction of the AI model [severity score, pus info, scar info] and the size of the lesion, we classify each pimple to one of the following types :
 - No acne
 - Microcomedone (also called early comedo)
 - Comedo
 - Papule
 - Pustule
 - Nodule
 - Cystic
 - Early papule / pustule
 - Resolving papule/ pustule



2 new acne types
returned by the API

Classification based on score and size of the lesion



Classification and acne types

- The API will output all these types, but depending on the usecase, one can choose to group /remove some acne types. It is to the dev team (according to the sales/business team opinions) to define how to show the results.
- For example :
 - We may not want to show the “early papule/pustule” to the users of belleSkin.
 - Some clients do not count “resolving papule/pustule” in the active lesions.
 - Some other clients prefer to group “early papules pustules” and “papules”.
 - etc
- FYI : No more separation between “blackheads” & “whiteheads”, it goes all to “comedo” (bMirror)

Configuration files

- New classification function aims to be adjustable for each use case (clients, apps)
- In order to do that, we now use configuration files (config_<usecase>.yaml) to define the values of each threshold (+ some other hyper-parameters)
- This configuration file is important because it impacts directly the AI prediction pipeline. Don't hesitate to contact the AI team (PIC : Léa Gazeau) for more information or for expertise for choosing the best parameters.
- We can consider to ask the clients their own configuration / thresholds to fit best their needs (radius and score)

Configuration files

```
acneai > configs > ! config_base.yml
...
1
2  img_quality: adaptive #can be either 1K, 2K, 4K, adaptive
3  check_skin_tone : False #can be True or False
4  seg_threshold: 0.25
5
6  # classification thresholds
7  pus_threshold: 0.5
8  scar_threshold: 0.5
9
10 microcomedo_radius: 0.5
11 comedo_radius: 1.5
12 papule_radius: 1.5
13 nodule_radius: 2.5
14
15 microcomedo_score: 0.25
16 comedo_score: 0.75
17 papule_score: 1.5
18 nodule_score: 3.5
19
```

img_quality: this parameter is important depending on the source of images we will receive. The quality and size of the image from the user plays an important role in the quality of the prediction.

- **2K:** we re-scale the image so that the face corresponds to 2000px for the acne segmentation step (medium resolution)
- **4K:** we re-scale the image so that the face corresponds to 4000px for the acne segmentation step (high resolution)
- **1K:** we re-scale the image so that the face corresponds to 1000px for the acne segmentation step (lower resolution)
- **adaptive:** we can re-scale to different resolutions depending on the input image (combine 1K and 2K resolution)

For this base configuration (to be used in belleSkin/Pro and the demo website), if one image is very low quality, then the predictions will be limited in term of detected acne because we keep the low resolution for the acne segmentation step resulting in less lesions detected (especially small lesions as micro-comedo).

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check_skintone: (Boolean) if True, then we check the output of skin tone prediction and normalize it for acne classification step (if it's skin tone 5or6). if False, we don't check the skin tone.

seg_threshold: should be a float between 0 and 1 (we recommend between 0.25 and 0.5) corresponds to the threshold of the AI output for the acne segmentation model.


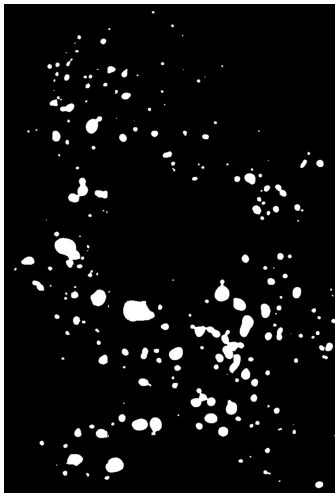
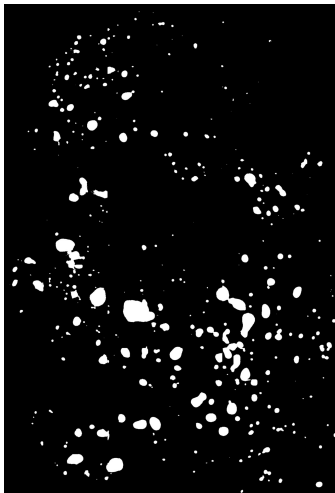
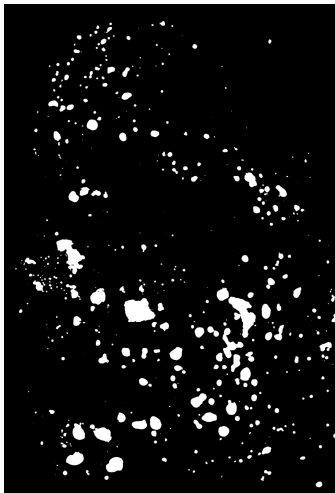
pus_threshold: should be a float between 0 and 1. if the pus information is below this value, then we consider there is no pus in this lesion, otherwise we consider there is pus.

scar_threshold: should be a float between 0 and 1. if the pus information is below this value, then we consider that the lesion is a scar and belongs to the 'no acne' class, otherwise, we classify it in one of the other acne types.

XX_radius : should be a float and corresponds to the limit radius of a lesion in mm.

XX_score : should be a float between 0 and 5 corresponding to the limit severity score of a lesion.

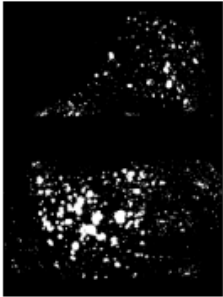
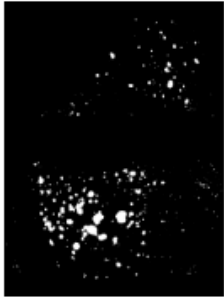


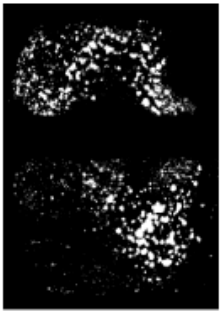
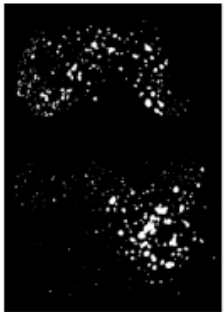
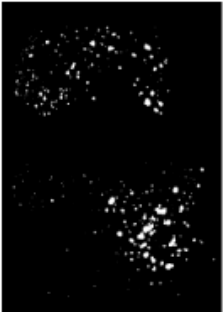
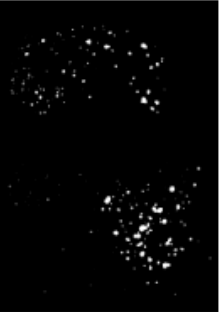
Impact of image quality on prediction

Original image	'1K size' segmentation	'2K size' segmentation	'4K size' segmentation
			

Increase details & precision in the prediction

Impact of acne seg_threshold on prediction

A higher threshold will reduce the sensitivity of the model --> will reduce the number of detected acne

Threshold	0.1	0.25	0.4	0.55
490.jpg				
607.jpg				

Reduce the sensitivity of the model --> less acne detected

