

Colony Count in a Cell Culture

By Akshat Maheshwari (20111006)

Introduction:

To estimate the number of cells present in a culture plate colony counting is done.



Motivation:

One day I was in my department's lab (BSBE), there I saw one of my friend counting number of colonies in a culture manually using pen and a counter. Watching her time and energy getting wasted in this encouraged me to think for an automated, software based solution.

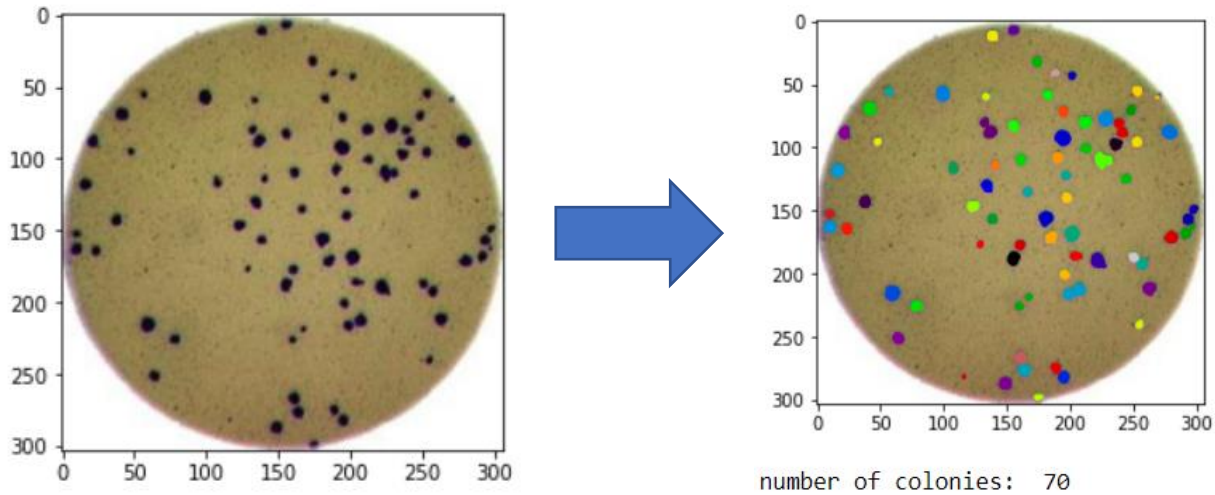
Problem:

Counting colonies is traditionally performed manually using a pen and a click-counter. This is generally a straightforward task, but can become very laborious and time-consuming when many plates have to be enumerated.



My Solution:

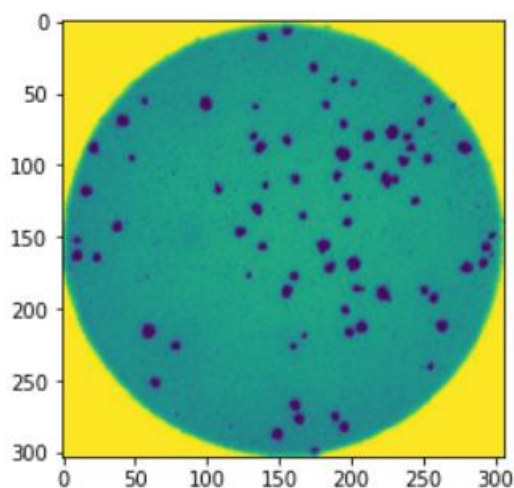
Uses python to automate this task by the help of a clustering algorithm called K-means clustering.



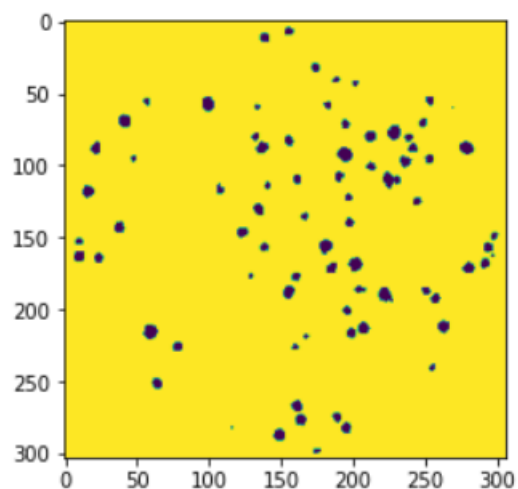
Method :

- 1) Converted image to Grayscale then convert it to black and white image using some threshold.

GreyScale Image:

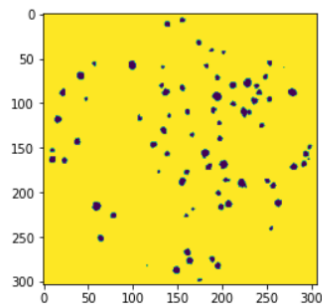


After filtering:

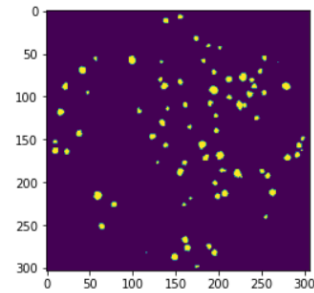


- 2) Used K-means to make a cluster of all the cell colonies and a cluster of everything except cell colonies.

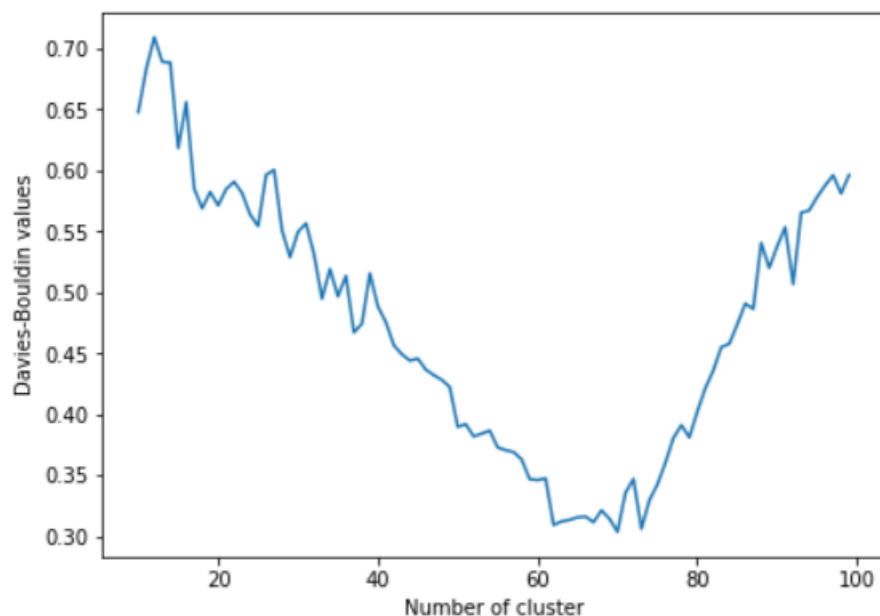
Cluster of everything except cell colonies:



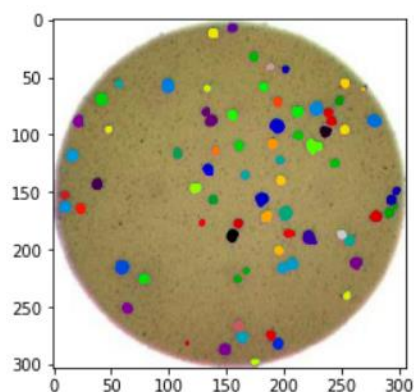
Cluster of cell colonies:



- 3) Converting the cell colonies cluster data to a distance-based data for K-means to cluster the cell colonies based on their distance.
- 4) Using Davis-Bouldin index to find the optimal number of clusters which is the predicted number of clusters. (It will take some time here, depends on what values you put in min_colonies and max_colonies)



- 5) Result



number of colonies: 70

Points to remember:

- 1) Culture image background should be light.
- 2) Media used in culture should be of light colour than the cells colony which should be darker than media.
- 3) Edit the image such that only the culture and media is visible, no petri plate should be visible, no reflection should be present in it.

Result:

Accuracy: $(\text{Predicted}/\text{Actual}) * 100$

Tested on 4 cultures:

- 1) Biotech_lab1: Accuracy = 91.67%
- 2) Biotech_lab2: Accuracy = 88%
- 3) Biotech_lab1: Accuracy = 98.59%
- 4) Biotech_lab1: Accuracy = 100%

References:

- 1) Biotech Lab samples
- 2) <https://datacarpentry.org/image-processing/09-challenges/index.html>