Deblending Blended Galaxy images using GANS

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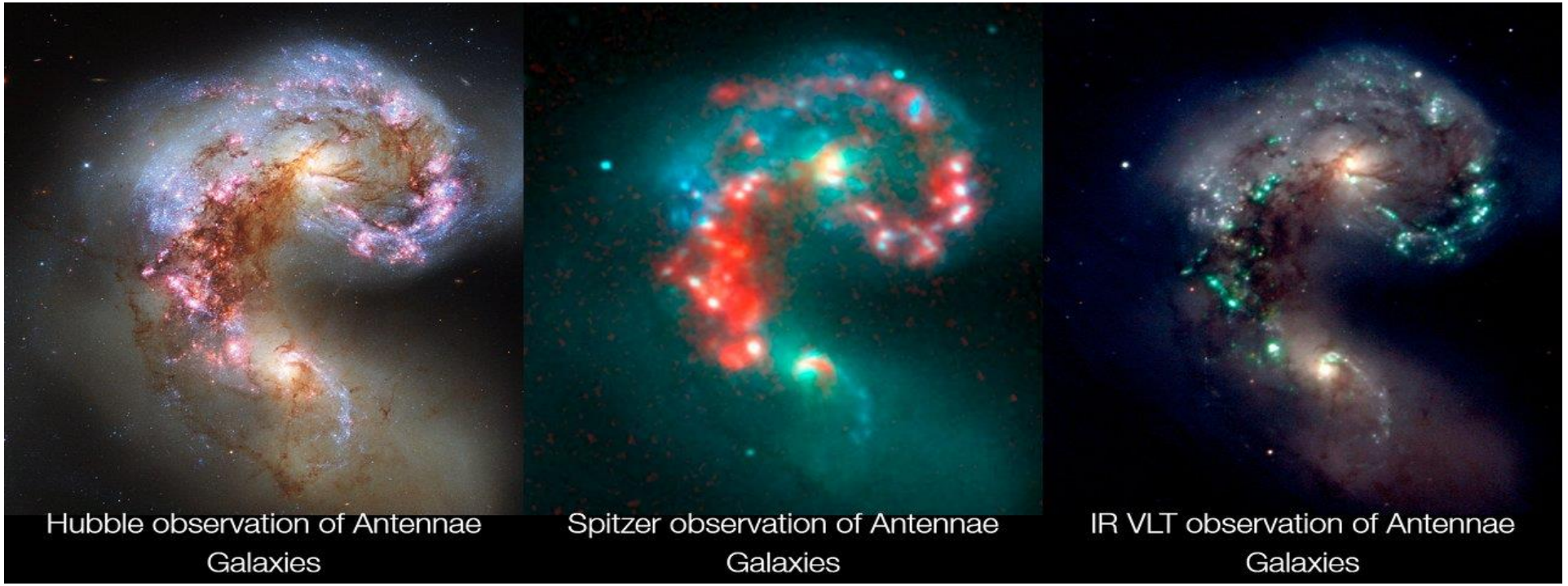
What is the problem exactly?

- Using deep neural networks to deblend galaxies that will be produced by future large-scale galaxy surveys at a fraction of up to 50% in the densest regions of universe.



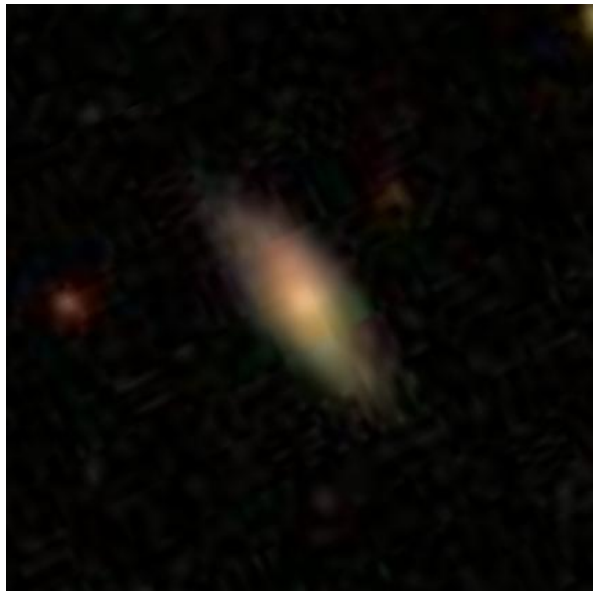
Eso.org [2]

Literature Overview

- To understand the problem:
  1. Deblending galaxy superpositions with branched generative adversarial networks. [4]
  2. Generative Adversarial Networks. [5][10]
  3. Object Detection with Deep Learning. [6]
  4. Addressing blending challenges with neural networks —A case study: Mask R-CNN. [7]
  5. Mask-RCNN. [8]

Literature Overview

- For implementation:
  1. Mask RCNN galaxy deblending technique: https://github.com/sowmyakth/galaxy_separation_mrcnn
  2. An open source neural network framework for Python: https://github.com/astroCV/darknet
  3. Galaxy segmentation using YOLO: https://github.com/astroCV/astroCV/tree/master/galaxy_detection_yolo3
  4. GAN architecture and implementation, Introduction to Deep Learning: http://d2l.ai/



Dataset:

- We used the data from 141,553 images available from Galaxy Zoo (https://academic.oup.com/mnras/article/410/1/166/1032478) via the Kaggle Galaxy Zoo classification challenge.
- The data has images like this:

Experimentation

"I have not failed. I've just found 10,000 ways that won't work." (Thomas Edison)

Failed Experiments

Tried to implement Branched GANs

Tried Using Mask RCNN to identify Galaxies.

Couldn't find any trained model

Had problems because the data consisted of fits file

We tried generating our own algo for galaxy detection.

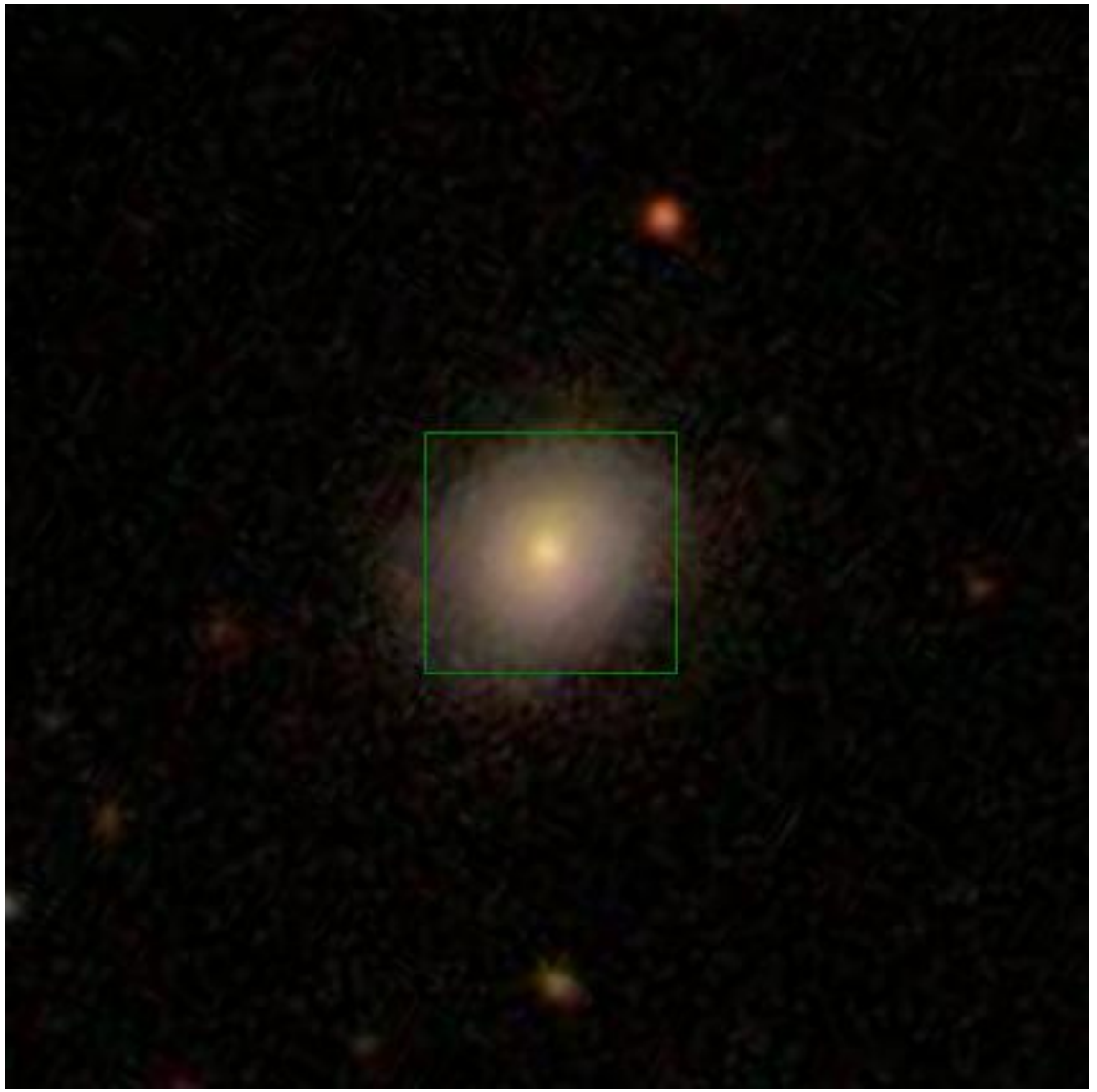


Fig A
Galaxy Detection

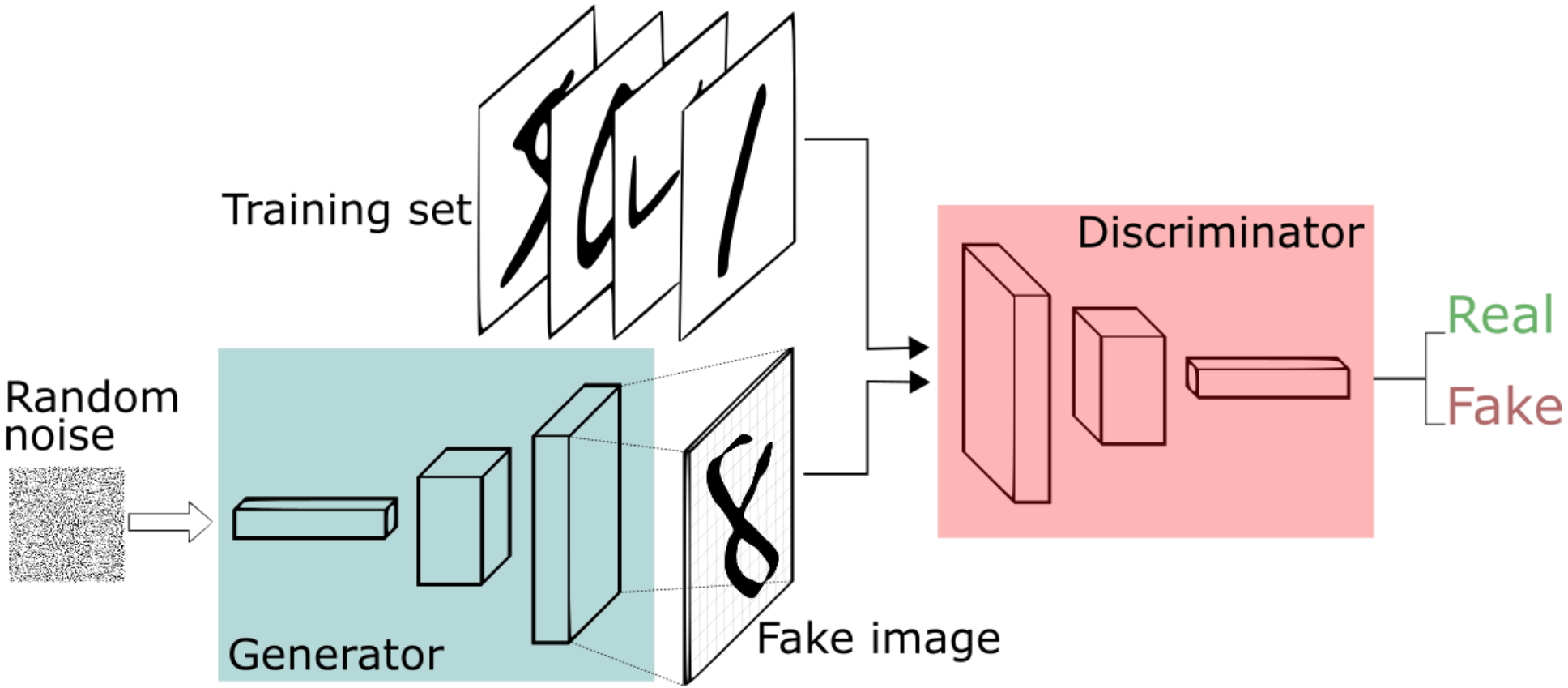
Final Experiment

Trained GAN to learn the distribution of galaxies by trying difference hyper parameters.

GAN was able to generate galaxy with random noise.

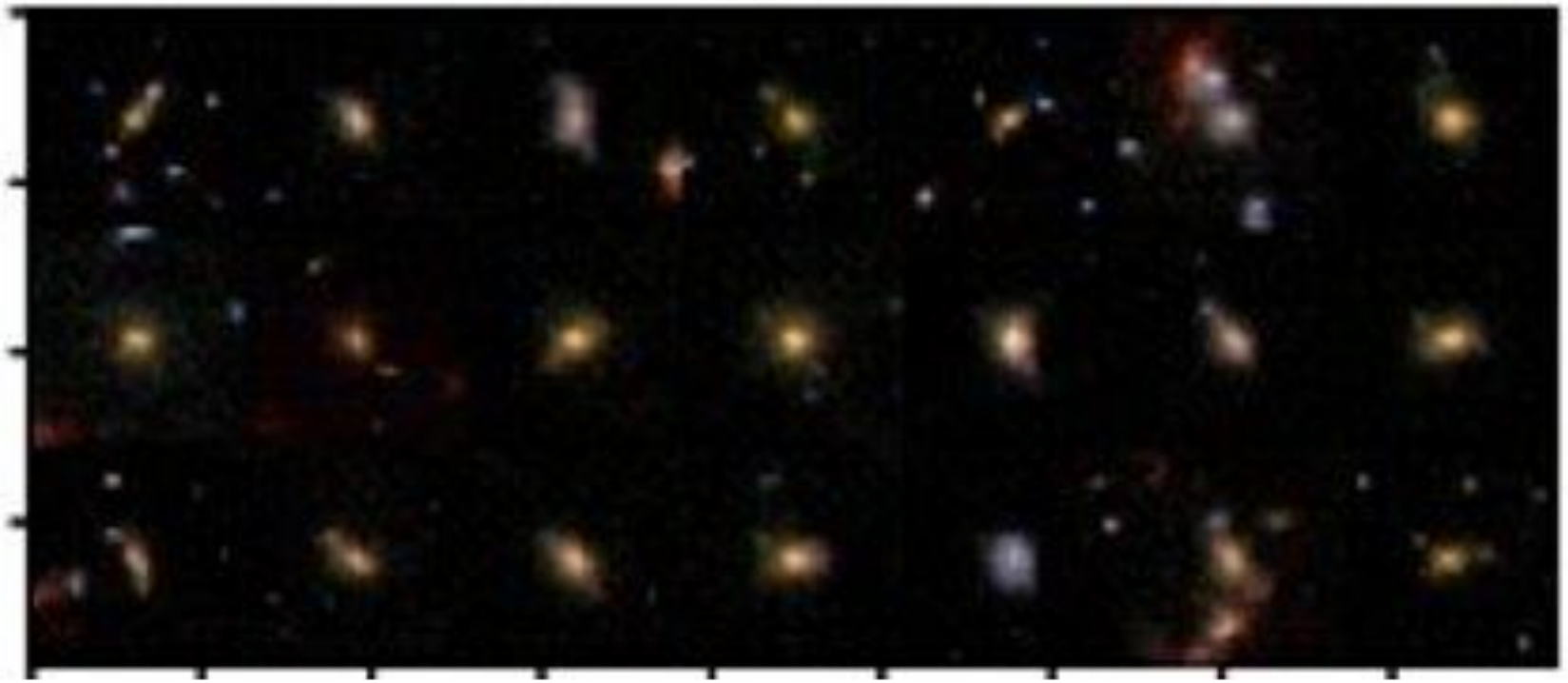
Gave GAN the input distorted images to check the results.

Model

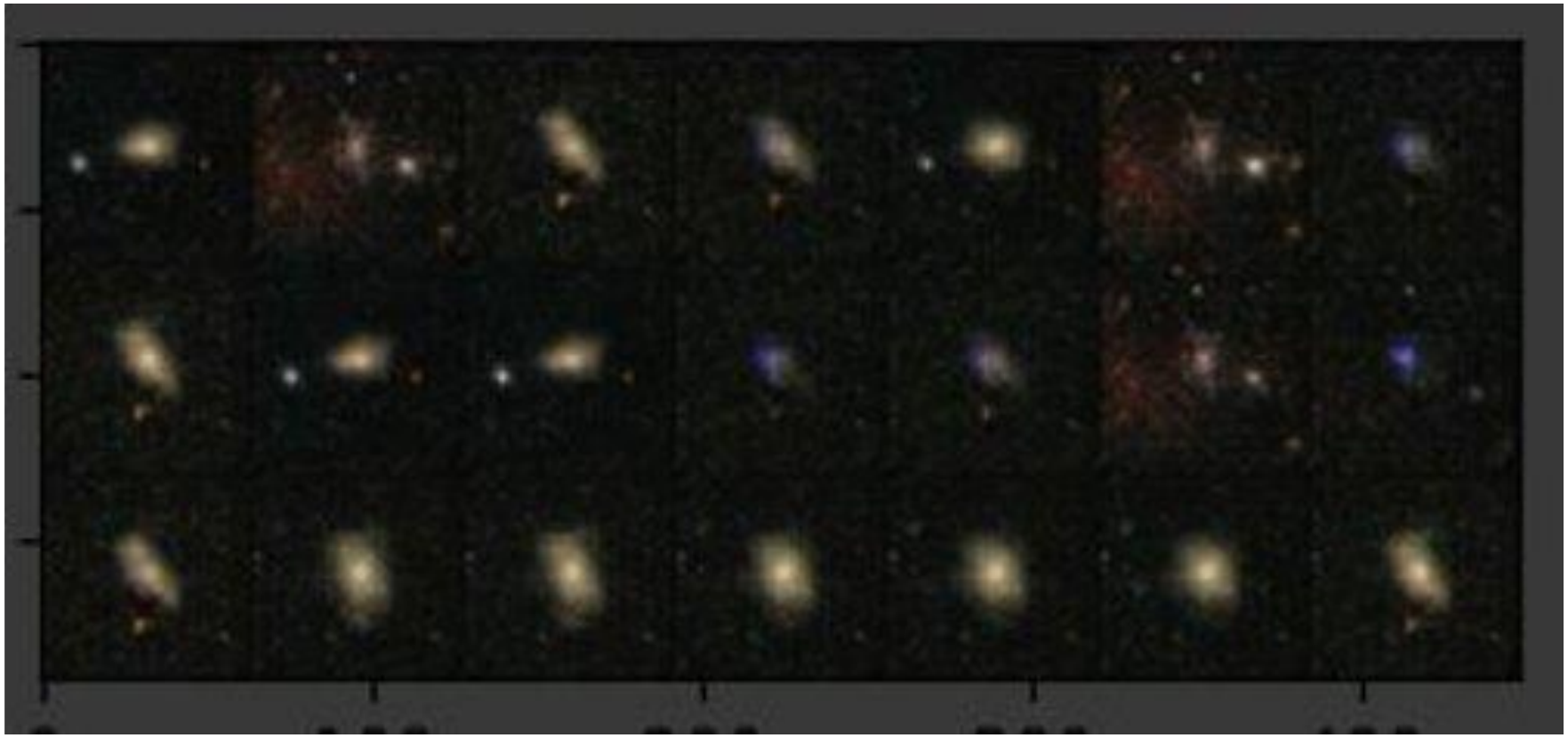

Training set
Random noise
Generator
Fake image
Discriminator
Real
Fake

Result

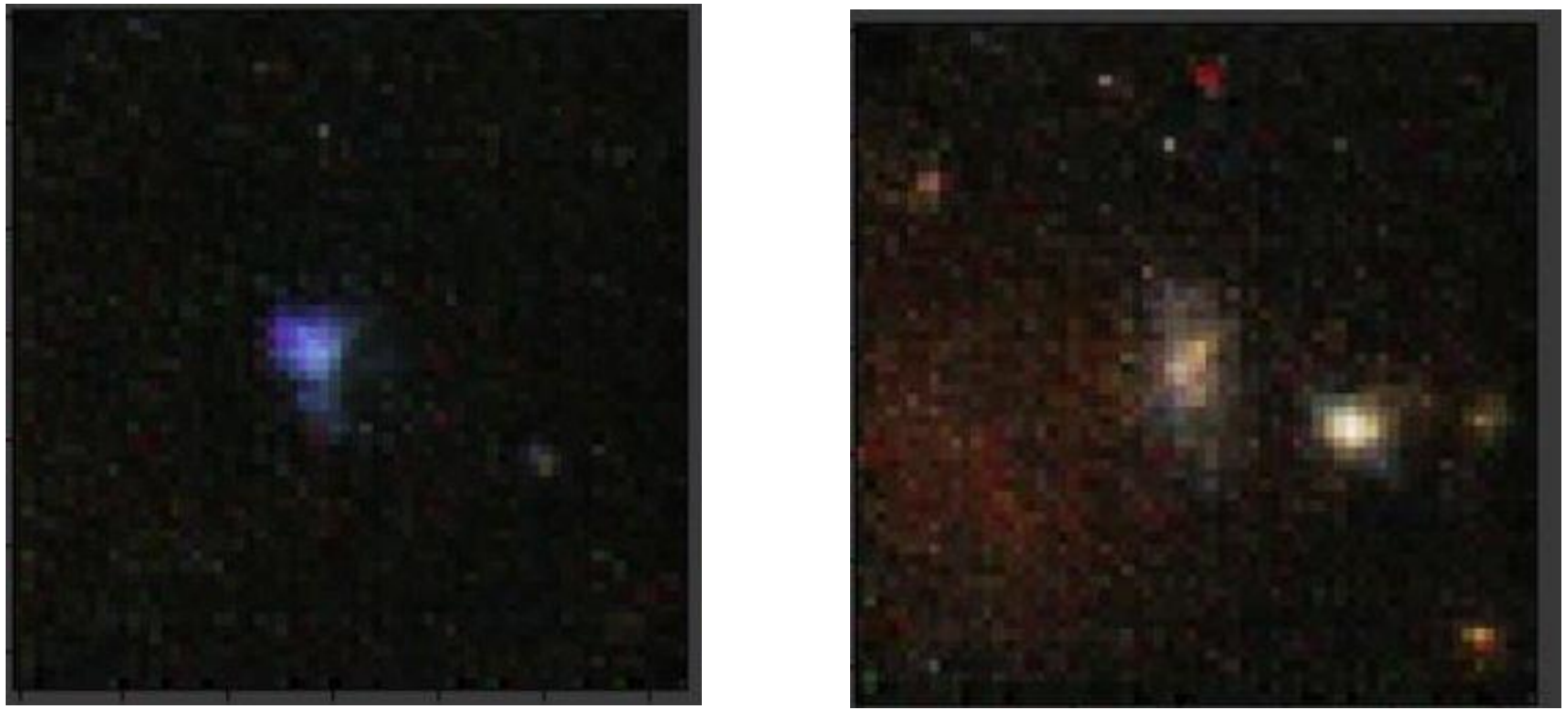
The result of GAN



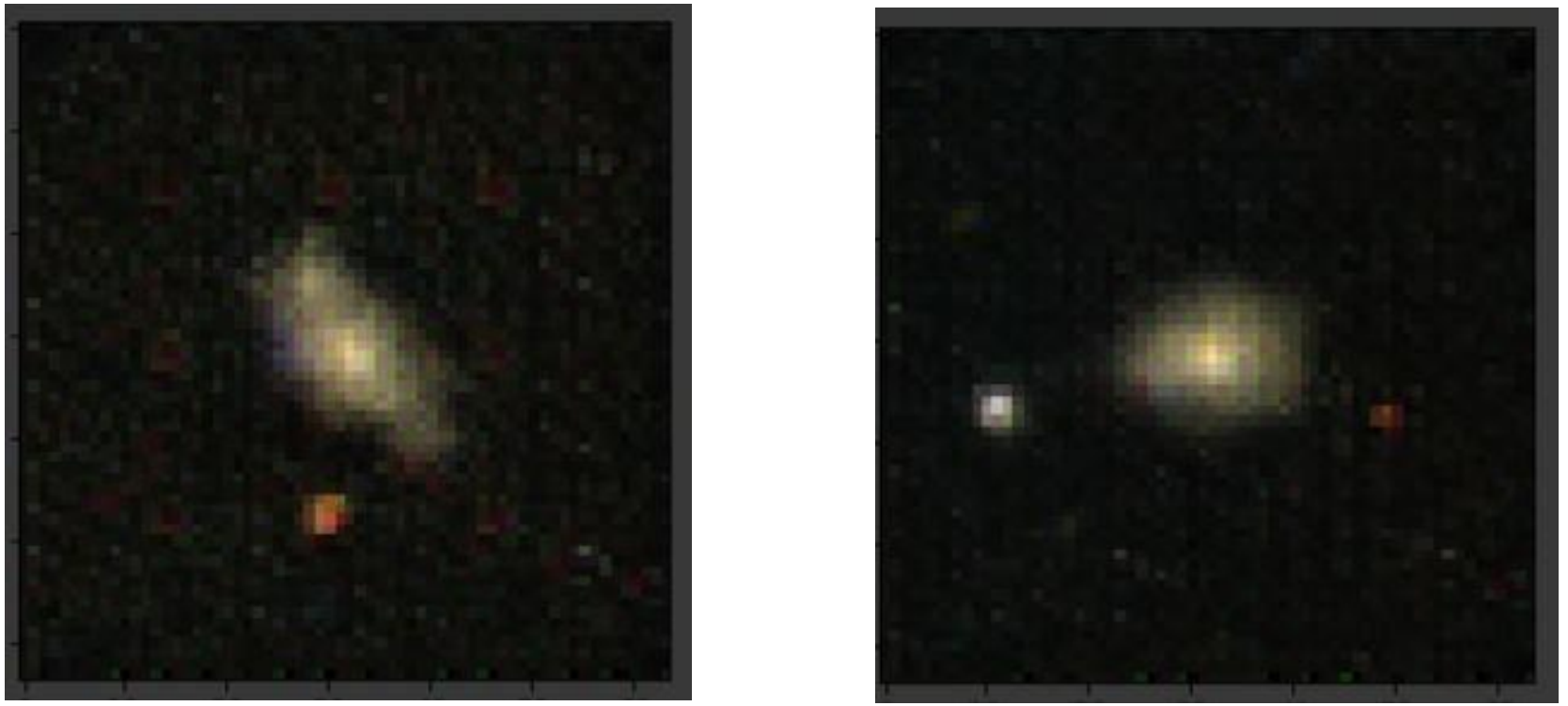
FigNo. 1
1000 images, 500 epochs



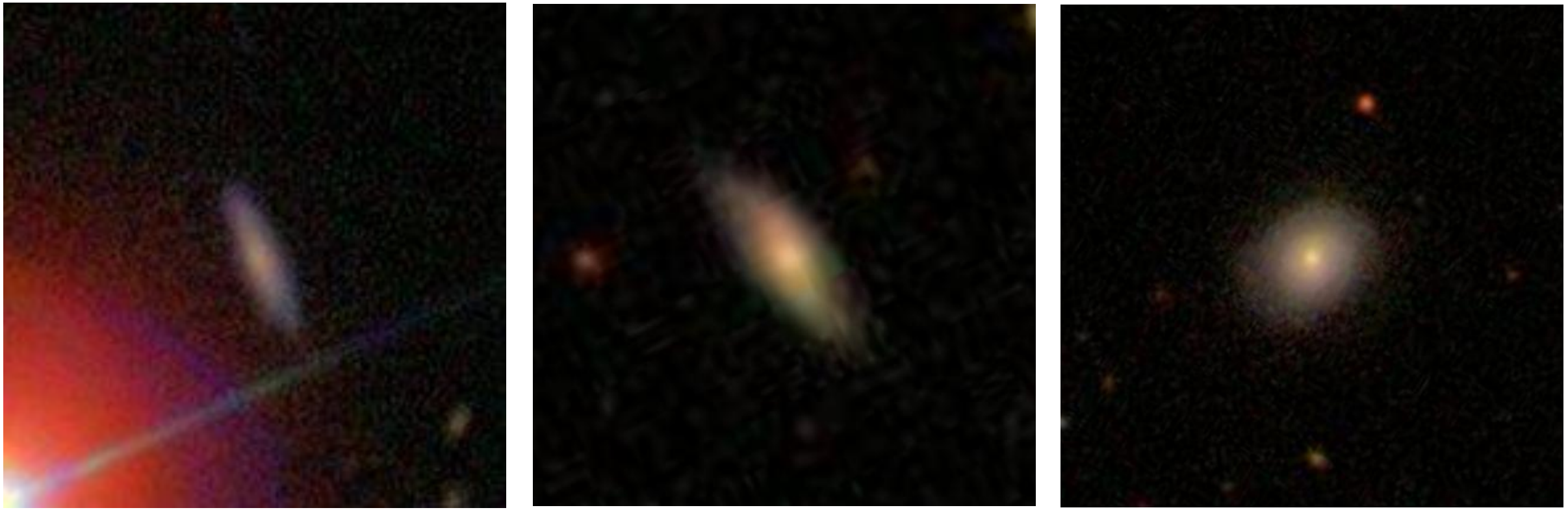
FigNo. 2
3000 images, 1000 epochs



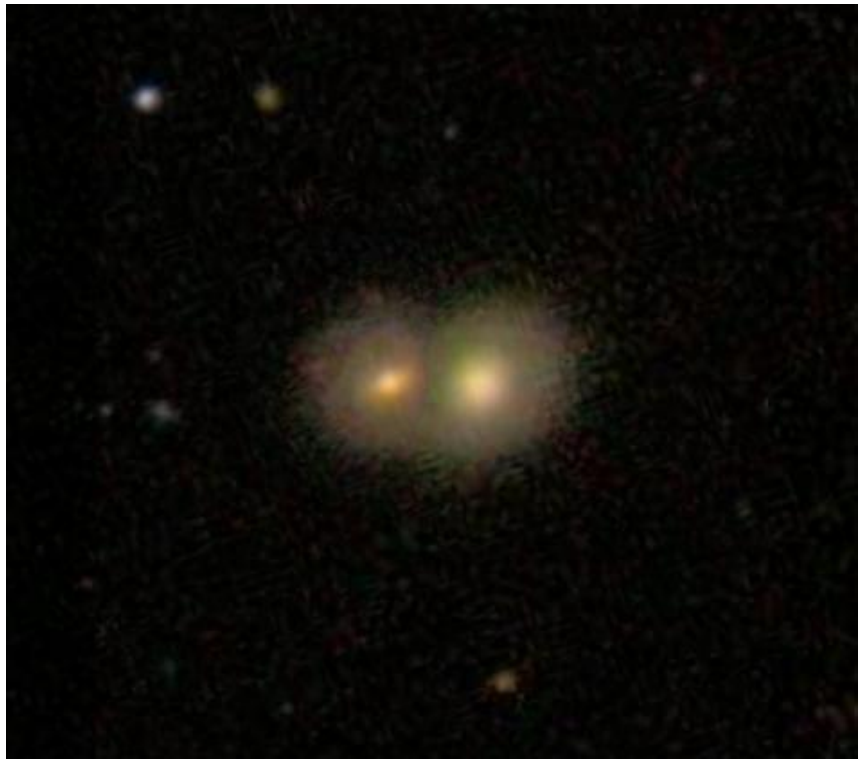
FigNo. 3
Images on random noise

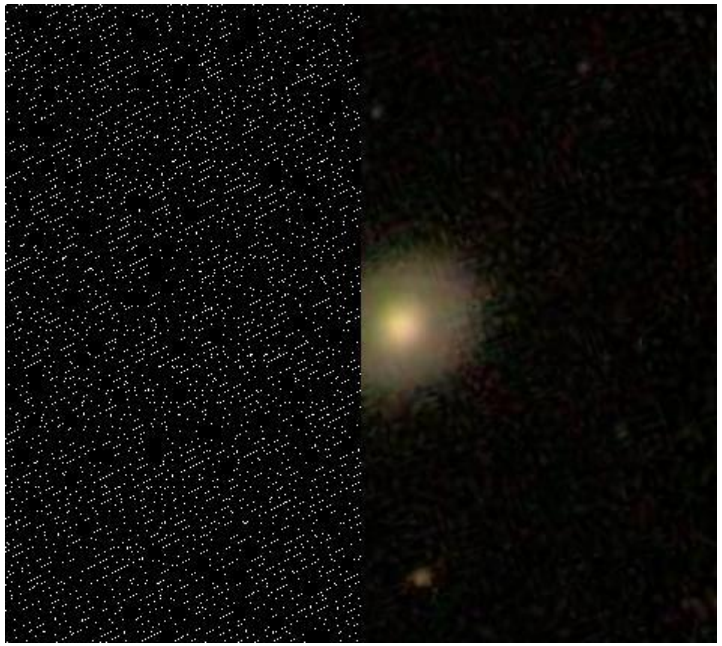


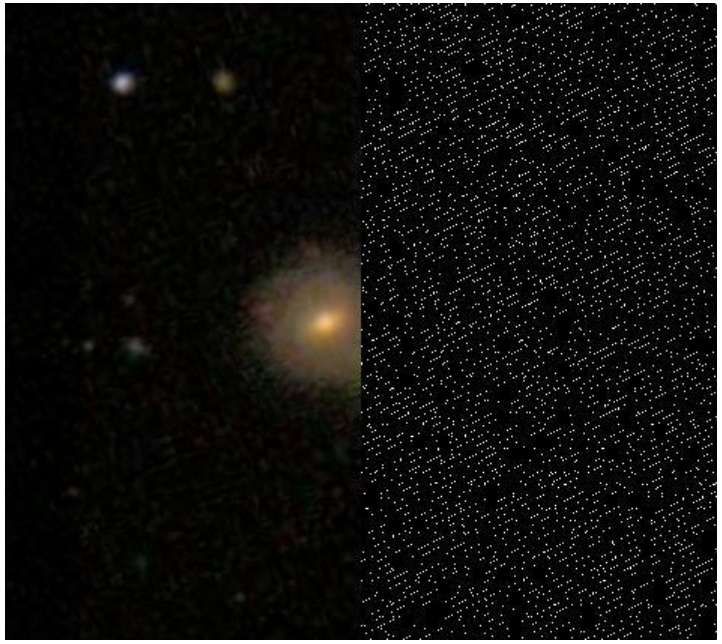
FigNo.4
Images on random noise



FigNo. 5
Comparision with real images

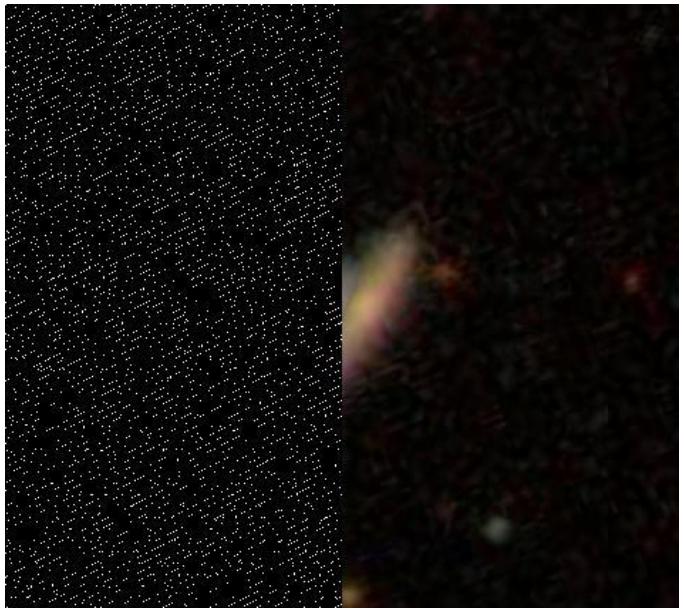


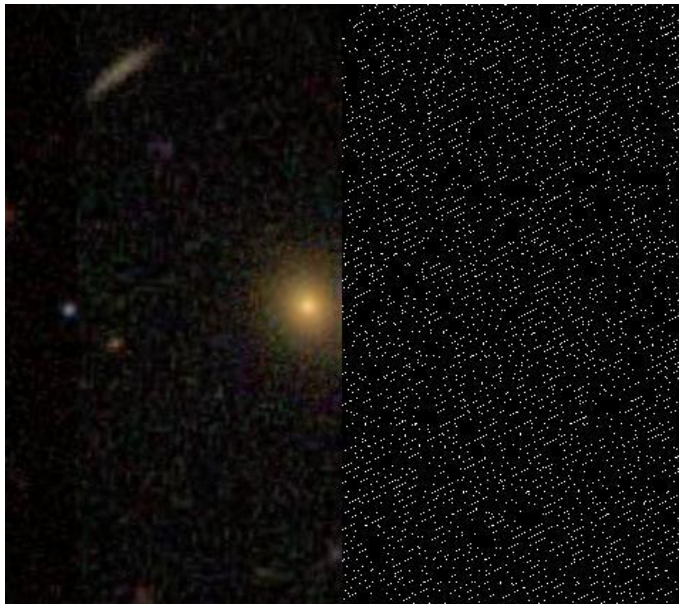


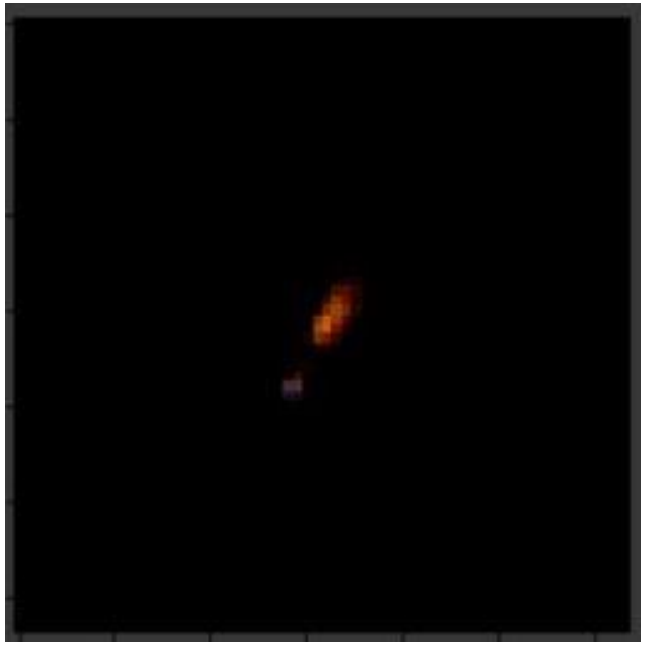


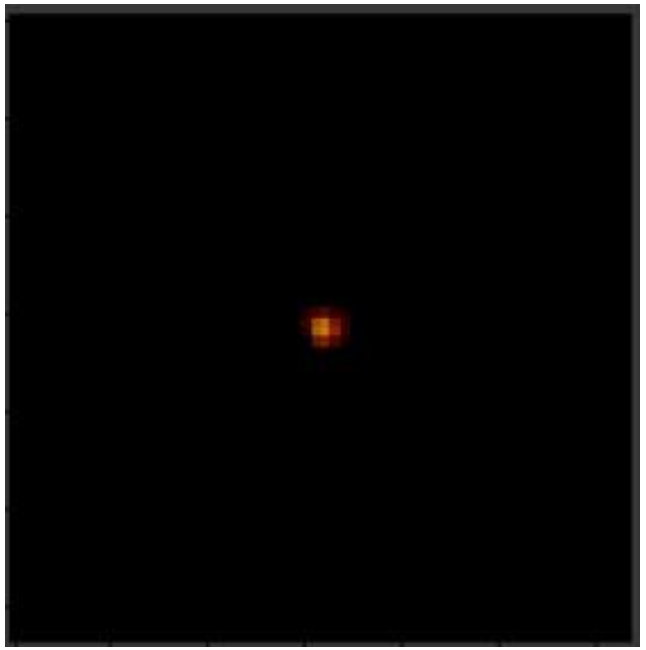
FigNo. 6
Segmentation with the assumption

FigNo. 7
Results on segmented images









Future Directions

To work on perfect segmentation

To make our model work for different types of blending.

To extend our research on how to de-blend other than spherical galaxies.

To find a method to de-blend more than two galaxies.

To work directly on fit files that will be generated by future large scale survey telescopes.

References

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