RNS INSTITUTE OF TECHNOLOGY

Channasandra, Bangalore - 560061

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FINAL YEAR PROJECT - WEEKLY REPORT

PROJECT TITLE :

MORPHOLOGICAL TAXONOMY OF GALAXIES USING CONVOLUTIONAL NEURAL NETWORKS

PROJECT GUIDE - Mrs Apoorva N H

PROJECT REVIEWER - Dr. Usha BS

TEAM MEMBERS :

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WEEKLY REPORT

WEEK 1

Dates : 21.9.2020 to 26.9.2020

Work Done:

- Preparation of project synopsis and review of the same.

Work Plan for next week:

- Discussion on the proposed project with the guide and preparation for Phase 1.

Signature of the Guide:

WEEK 2

Dates : 28.9.2020 to 3.10.2020

Work Done:

- Detailed literature survey of 8 papers. Papers surveyed are as follows:

1. Galaxy Morphology Classification
   Alexandre Gauthier, Archa Jain, and Emil Noordeh, Stanford University (Dated: December 16, 2016)
2. Classification of Galaxy Morphological Image Based on Convolutional Neural Network Wahyono, Muhammad Arif Rahman, and Azhari SN.
3. Convolutional Neural Networks For Galaxy Morphology Classification Diego Castillo, Ankur Shukla, Tristan Wright
4. Galaxy Classification with deep convolutional neural networks Honghui Shi (Masters Thesis- University of Illinois Urbana-Champaign)

5. Improving galaxy morphologies for SDSS with Deep Learning
   H. Domnguez Sanchez,M. Huertas-Company, M. Bernardi, D. Tuccillo and J. L. Fischer (9 February 2018)
6. Combining human and machine learning for morphological analysis of galaxy images Joe George,Evan Kuminski, John Wallin, Lior Shamir.
7. Machine and Deep Learning Applied to Galaxy Morphology (P. H. Barchia,, R. R. de Carvalhoc,d, R. R. Rosaa, R. A. Sauttera, M. Soares-Santosb)
8. Deep Convolution Neural Networks for Galaxy Morphology Classification.(Gaurav Kiran Tiwari1, Pooja N Mishal2, Prof. Tejaswini Bhoye3)

Work Plan for next week:

- Preparation of PPT for phase I.

Signature of the Guide:

WEEK 3

Date : 19.10.2020 to 24.10.2020

Work Done:

- Preparation and Presentation of Phase 1.

Work Plan for next week:

- Getting started with the Project.

Signature of the Guide:

WEEK 4

Dates : 26.10.2020 to 31.10.2020

Work Done:

- Performed image processing on the dataset.
- Processing involved resizing and data augmentation.

Work Plan for next week:

- Applying different filters to the dataset.

Signature of the Guide:

WEEK 5

Dates : 2.11.2020 to 7.11.2020

Work Done:

- Performed Histogram Equalization (CLAHE) and Median filtering on the augmented dataset.

Work Plan for next week:

- More detailed literature survey

Signature of the Guide:

WEEK 6

Dates : 09.11.2020 to 14.11.2020

Work Done:

- Detailed literature survey (12 additional papers referred)

1. Shape Descriptors in Morphological Galaxy Classification Ishita Dutta , S. Banerjee & M. De
2. Machine Learning and Image Processing in Astronomy with sparse datasets John Jenkinson, Artyom Grigoryan, Mehdi Hajinorooz, Raquel D´ıaz Hernandez, Hayde Peregrina Barreto, Ariel Ortiz Esquivel, Leopoldo Altamirano, Vahram Chavushyan
3. Classifying Radio Galaxies with the convolutional Neural Networks A. K. Aniyan, K. Thorat
4. Automated Classification of Galaxy Images Jorge de la Calleja, Olac Fuentes
5. Advanced Image Processing for Astronomical Images Diganta Misra, Sparsha Mishra, Bhargav Appasani
6. Morphological Classification of galaxies using Artificial Neural Networks Storrie-Lombardi, M.C Lahav, Sodre L Jr
7. Self-supervised Learning for Astronomical Image Classification Ana Martinazzo, Mateus Espadoto, Nina S. T. Hirata
8. Knowledge Based Morphological Classification of Galaxies from Vision Features. Devendra Singh Dhami,David Leake,Sriraam Natarajan
9. Galaxy Image Classification using Non-Negative Matrix Factorization I.M.Selim ,Arabi E. Keshk ,Bassant M.El Shourbugy
10. Deep Galaxy V2: Robust Deep Convolutional Neural Networks for Galaxy Morphology Classifications (Nour Eldeen M. Khalifa Mohamed Hamed N. Taha ,Aboul Ella Hassanien, I. M. Selim 2)
11. Galaxy Morphology Classification with Deep Convolutional Neural Networks(Jia-Ming Dai, Jizhou Tong)
12. Machine Learning for Galaxy Morphology Classification(Adam Gauc, Kristian Zarb Adam, John Abela)

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Work Plan for next week:

- Vgg-16 architecture implementation

Signature of the Guide:

WEEK 7

Dates : 16.11.2020 to 21.11.2020

Work Done:

- Implementation of CNN Architecture.
- Implemented VGG16 architecture with 13 convolutional layers and 3 fully connected layers and a softmax layer at the end with ReLU as activation layer.

Work Plan for next week:

- Start with the final report.

Signature of the Guide:

WEEK 8

Dates : 23.11.2020 to 28.11.2020

Work Done:

- Completion of the first two chapters of the final report (Chapter 1 - Introduction : Motivation, Objectives, Methodology, Advantages and Chapter 2 - Literature survey with summaries of the 20 papers reviewed).

Work Plan for next week:

- Preparation for Phase 2 Presentation.

Signature of the Guide:

WEEK 9

Dates : 7.12.2020 to 12.12.2020

Work Done:

- Preparation and Presentation of Phase 2
- Wrote a code to display feature extraction in VGG16 for showing the output of the CNN architecture.

Work Plan for next week:

- Model training and publishing a literature survey paper.

Signature of the Guide:

WEEK 10

Dates : 01.03.2021 to 07.03.2021

Work Done:

- Drafted the abstraction,introduction,data preprocession sections of the literature survey paper.

Work Plan for next week:

- Drafting the models, result and conclusion sections of the literature survey paper.

Signature of the Guide:

WEEK 11

Dates : 08.03.2021 to 14.03.2021

Work Done:

- Drafted the models,result and conclusion sections of the literature survey paper.

Work Plan for next week:

- Converting drafted paper to IEEE format using Latex.

Signature of the Guide:

WEEK 12

Dates : 15.03.2021 to 21.03.2021

Work Done:

- Drafted Survey paper was converted inti IEEE format using Latex.

Work Plan for next week:

- Training The different models.

Signature of the Guide:

WEEK 13

Dates : 22.03.2021 to 28.03.2021

Work Done:

- We began the training process of the project. We worked on 9 models in total. We worked on Model 1,2 and 3 in this week with RMSPROP optimizer and different learning rates to compare the performances.

Work Plan for next week:

- Experiment with different datasets and optimizers in more models.

Signature of the Guide:

WEEK 14

Dates : 29.03.2021 to 04.04.2021

Work Done:

- We worked more on the hyperparameter tuning of our models and also experimented with the datasets to compare the performances.
- We worked on Models 4,5 and 6. Models 4 and 5 used the original dataset which showed a poorer performance compared to our preprocessed versions.

Work Plan for next week:

- Experiment with different datasets and optimizers in more models.

Signature of the Guide:

WEEK 15

Dates : 05.04.2021 to 11.04.2021

Work Done:

- We worked on Models 7 and 8 with Adam optimizer with different number of epochs and Adam optimizer gave better results than RMSProp optimizer.

Work Plan for next week:

- Working on model 9 (final model).

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Signature of the Guide:

WEEK 16

Dates : 12.04.2021 to 18.04.2021

Work Done:

- Model 9 was run in 3 different runs instead of a single run. Each run had different number of epochs.
- The model had 6,7 and 9 epochs in each run respectively. This yielded a much better result than the previous models.

Work Plan for next week:

- Working on the prediction part for model 9.

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Signature of the Guide:

WEEK 17

Dates : 19.04.2021 to 25.04.2021

Work Done:

- We wrote a code using Model 9 (Final model), so that it takes a single image as the input and predicts the features of the galaxy image and prints the features as the output.

Work Plan for next week:

- Work on the deployment part of the model..

Signature of the Guide:

WEEK 18

Dates : 26.04.2021 to 2.05.2021

Work Done:

- Started with the deployment part of the project. We worked on the frontend web interface deployment with HTML and CSS.

Work Plan for next week:

- Work for Phase 3 presentation.

Signature of the Guide :

WEEK 19

Dates : 03.05.2021 to 9.05.2021

Work Done:

- Preparation and Presentation of Phase 3

Work Plan for next week:

- Working on Deployment (Backend).

Signature of the Guide :