Module 4 : Literature Review and Software Tooling

Task 1

- Create a bibliography file related to your research topic and review atleast 2 research papers listing major strengths and weakness of the presented work in the research papers.

1. A .bib file has been created and uploaded.
2. Research papers were cited in IEEE style.
3. I am working on developing light weight convolutional neural networks for Quantitative Susceptibility Mapping (QSM). QSM is an inverse problem (also known as dipole deconvolution) that maps pre-processed MR phase information to tissue susceptibility. Susceptibility is an intrinsic property of the tissue and provides novel MRI contrast. The traditional algorithm known as COSMOS [1] is the gold standard for QSM reconstruction, however it requires data from multiple head orientations and results in long scan time. There is one more technique called Thresholded k-space division (TKD) [2] that simple truncates the dipole kernel in Fourier space (k-space) to solve the dipole deconvolution problem.
4. COSMOS [1] :
    - Strengths : The algorithm is Fast, it is independent of the ill posedness of the dipole kernel.
    - Weakness : Requires long scan time since the data need to be acquired from multiple orientations resulting in patient dis-comfort.
5. TKD method [2] :
    - Strengths : The algorithm is Fast, minimal scan time as it does not require the data from multiple orientations.
    - Weakness : Threshold required to truncated the dipole kernel is a hyper parameter and, such truncation results in streaking artifacts.

Task 2

- Create a github pages of your own.(a). One your home page (could be google pages as well).(b). One your projects page.

1. My home page can be found here, the projects page is here and, the github page is here.

Task 3

- Select datasets from https://data.gov.in/ and create (a) a scatter plot, (b) a box plot, and (c) a bar or line plot from them using matplotlib library. Upload the plots and the Python scripts you wrote to this repository as a single zip file, and include a Readme.md documentation for the same listing the data sources and the observations from the plots, including citations. Use the git or svncommand line clients to perform these operations.

1. The case study is of percentage of schools having Computers from 2013-14 to 2015-16 in India. The details (data in %) are available year wise, state wise and also Overall (across India). The data is available here. The python codes of the analysis done can be found here.

2. At an average, the percentage of schools having computer facilities is ~ 25 %. According to the plots shown in Fig.1 there is not much improvement in terms of computer facilities from 2013-16.

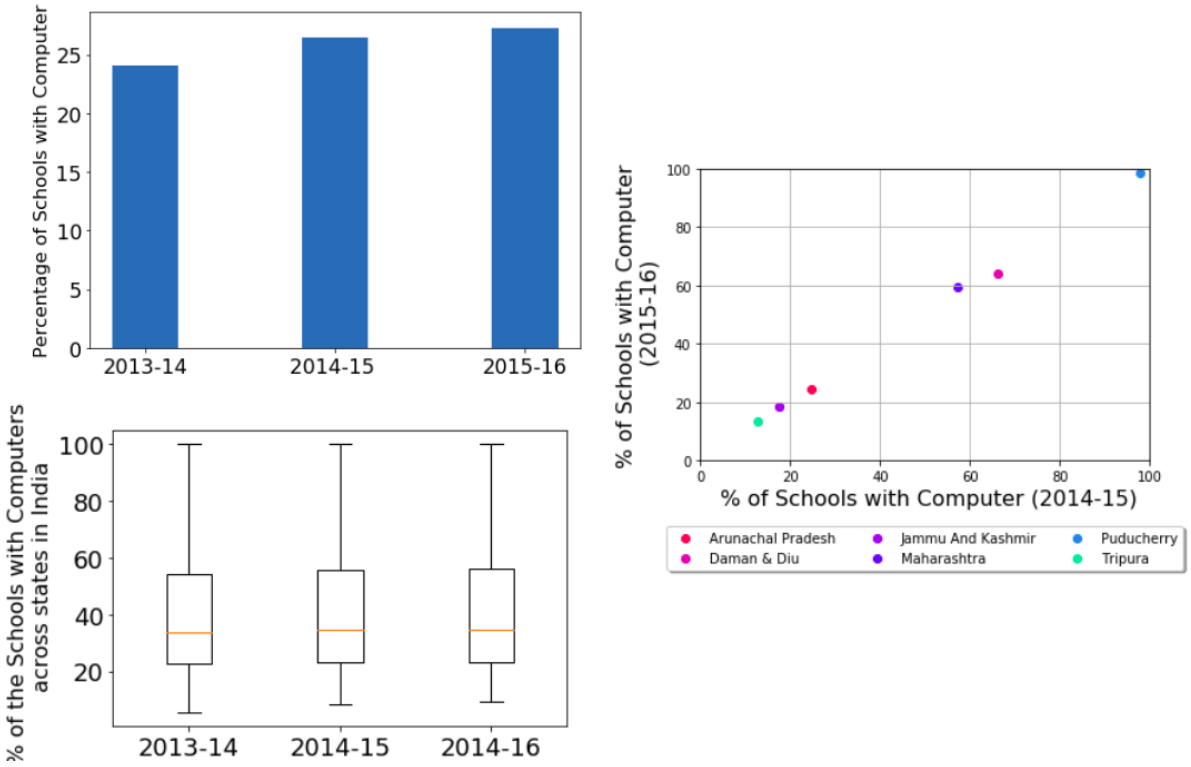

Figure 1: Detailed analysis of computer facilities in schools across India from 2013-2016.

References

[1] T. Liu, P. Spincemaille, L. De Rochefort, B. Kressler, and Y. Wang, "Calculation of susceptibility through multiple orientation sampling (cosmos): a method for conditioning the inverse problem from measured magnetic field map to susceptibility source image in mri," *Magnetic Resonance in Medicine: An Official Journal of the International Society for Magnetic Resonance in Medicine*, vol. 61, no. 1, pp. 196–204, 2009. [Online]. Available: https://doi.org/10.1002/mrm.21828

[2] K. Shmueli, J. A. de Zwart, P. van Gelderen, T.-Q. Li, S. J. Dodd, and J. H. Duyn, "Magnetic susceptibility mapping of brain tissue in vivo using mri phase data," *Magnetic Resonance in Medicine: An Official Journal of the International Society for Magnetic Resonance in Medicine*, vol. 62, no. 6, pp. 1510–1522, 2009. [Online]. Available: https://doi.org/10.1002/mrm.22135