Improving NMF result confidence in spectrum analysis using deep learning

Abstract

Signal denoising is a central task in several fields such as Computer Vision, Astrophysics and so on. In particular, extracting noise from radiative spectra is still an open question and it is very important for the characterization of the constituent elements related to this atomic spectra. The negative matrix factorization (NMF) is one of these methods which allows to extract the prominent elements from spectra ; nevertheless it is very sensitive to noise. On the other hand, artificial intelligence (AI) shows very good ability to disentangle complex inputs and allows image unblurring, pattern recognition among others. The work presented here aims to use neural networks in specific architectures to identify and subtract the noise from noisy spectra, and to explore the possibility to improve the confidence of the NMF output without hurting its already good recognition performance. From noiseless signal, we try different types of noise : real experimental and Gaussian noises. We started with the residual learning framework in which we identify the noise profile and output an approximate noiseless data through a 1D convolutional neural network (CNN). After having trained the model, we evaluate its generalization ability and compare the NMF output and confidence using or not the trained model as denoiser. This work is still on progress, nevertheless preliminary results are already encouraging.