

8. Future work and conclusion

We have discussed a novel chemical detection scheme based on adaptive feature specific spectroscopy. Simulation results with regard to a pharmaceuticals library illustrated that AFSS systems perform dramatically better than traditional systems. Using a digital micro-mirror device as the primary adaptive element, an AFSS system was designed and used to validate our theoretical findings. The experimental results using a custom LED spectral library matched the results of our simulations very closely. The results clearly stress the benefits of such an adaptive system with regard to classification time in extremely critical application areas like defense, security and medicine.

There is always a possibility of finding a set of unique feature vectors which are more discriminatory in nature when compared with the ones synthesized using principal component analysis (it has already been stated that feature vectors based on principal components are essentially *ad hoc* in nature). Further research is being carried on in this regard to determine the globally optimal feature vectors. Information optimal features have already been designed and implemented in the imaging domain where they have proven to perform better than the adaptive feature specific schemes in the low task SNR regions [25].

The variation of the performance of the AFSS system as a function of the size of the library is currently being studied. Such spectroscopic techniques may also be made to maximum use by utilizing such setups to perform operations like concentration estimation and other parameter estimation with respect to the chemicals being investigated.

Acknowledgements

The authors gratefully acknowledge the support of the Defense Advanced Research Projects Agency (DARPA) Knowledge Enhanced Compressive Measurements Project (KECoM) through contract #N66001-10-1-4079.