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DETERMINING SENATORIAL VOTING ARCHETYPES THROUGH HYPERSPECTRAL UNMIXING

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ELECTION RESULTS VS SATELLITE IMAGES

The Philippine election results can be compared to a single hyperspectral satellite image where **each pixel is one clustered precinct**. Linear unmixing assumes that the emission spectrum of each pixel is just a **linear combination of archetypes**. Each clustered precinct may be described the same way. A major assumption in this work is that voting archetypes exist.

HYPERSPECTRAL UNMIXING

Hyperspectral unmixing aims to estimate **M** and **A** in:

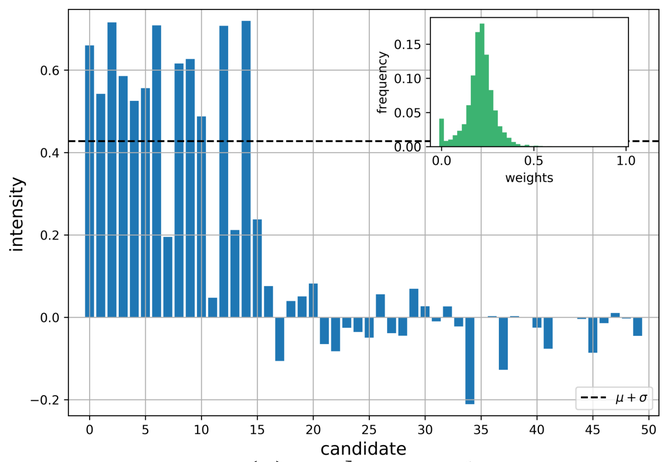
$$\boldsymbol{Y = MA + N}$$

where **Y** is the observed **spectral matrix**, **M** is the **mixing matrix**, A is the **abundance matrix**, and **N** is the **noise matrix**[1-4]. This is subject to the **positivity constraint** $\boldsymbol{A \geqslant 0}$ and the **sum constraint** $\boldsymbol{1_p^T A = 1_n}$.

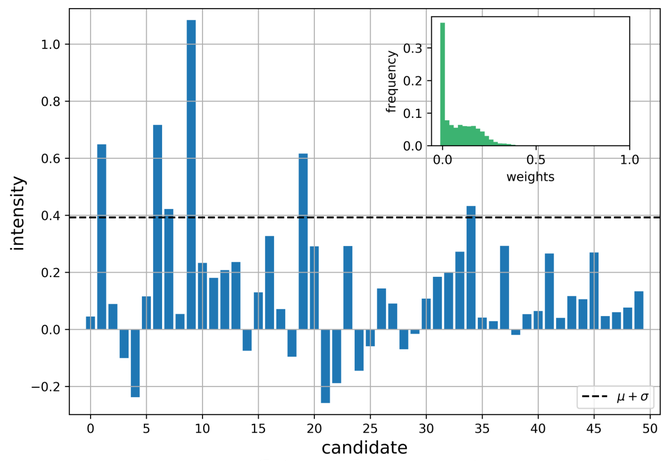
METHODS

- **partial election results** as of 05/09/16 5:42 pm from http://elections.org.ph
- matrix with **rows corresponding to a precinct** and **columns corresponding to results**
- determine the number of archetypes **(HySime)**[1], estimate the mixing matrix **(VCA and MVSA)**[2-3], and abundance matrix **(SUnSAL)**[4]

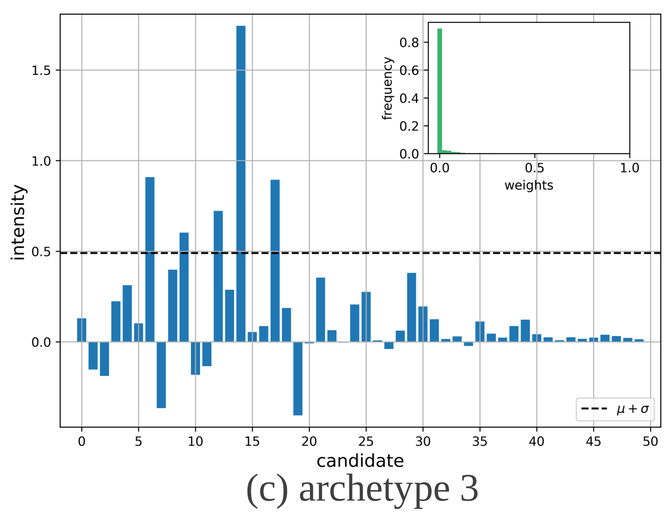
VOTING ARCHETYPES WITH WEIGHT DISTRIBUTION



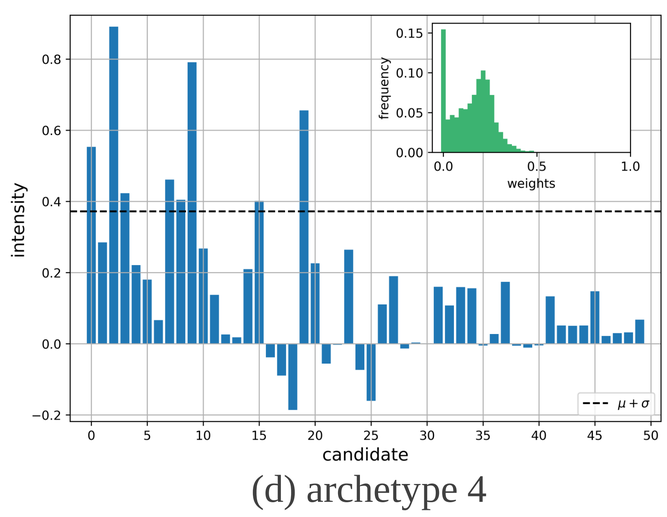
(a) archetype 1



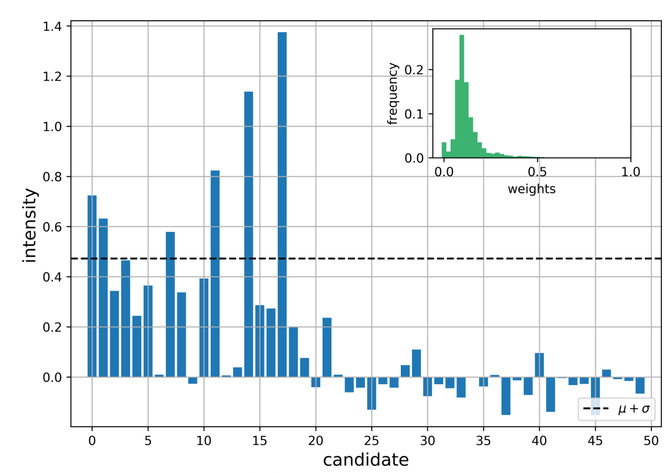
(b) archetype 2



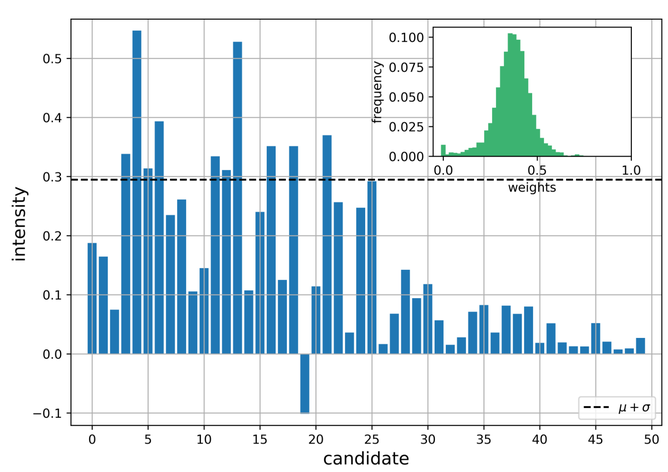
(c) archetype 3



(d) archetype 4



(e) archetype 5



(f) archetype 6

Each archetype can represent:

- **first** – winning candidates
- **second & third** - candidates that received the most media coverage[6]
- **fourth** – celebrity voting[7]
- **fifth** – candidates that have run locally

CONCLUSION

Our use of hyperspectral image processing techniques on election results was motivated by the **empirical notion that there are voting patterns in Philippine elections**. Our results, so far, seem to be **supporting this notion**.

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