ML Project Proposal

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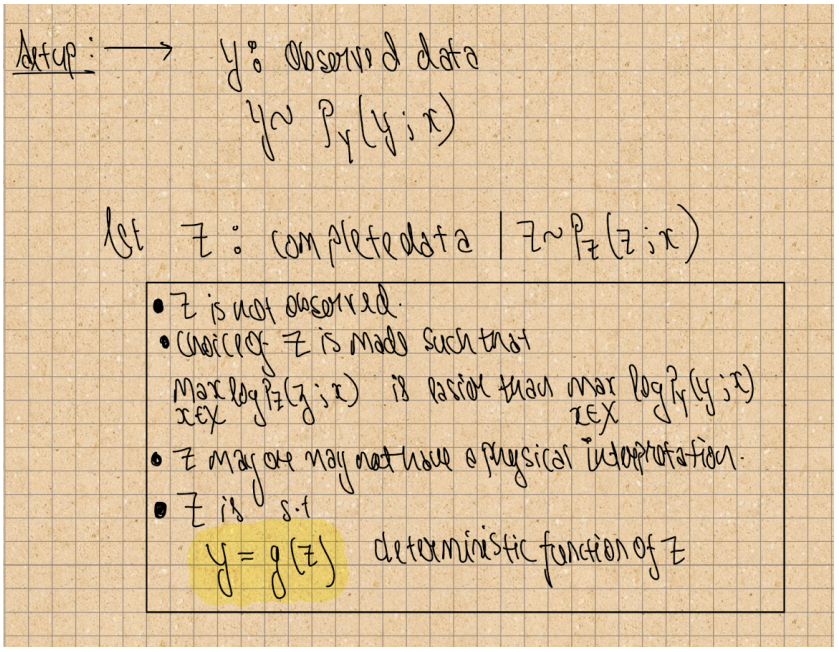
1. Overview

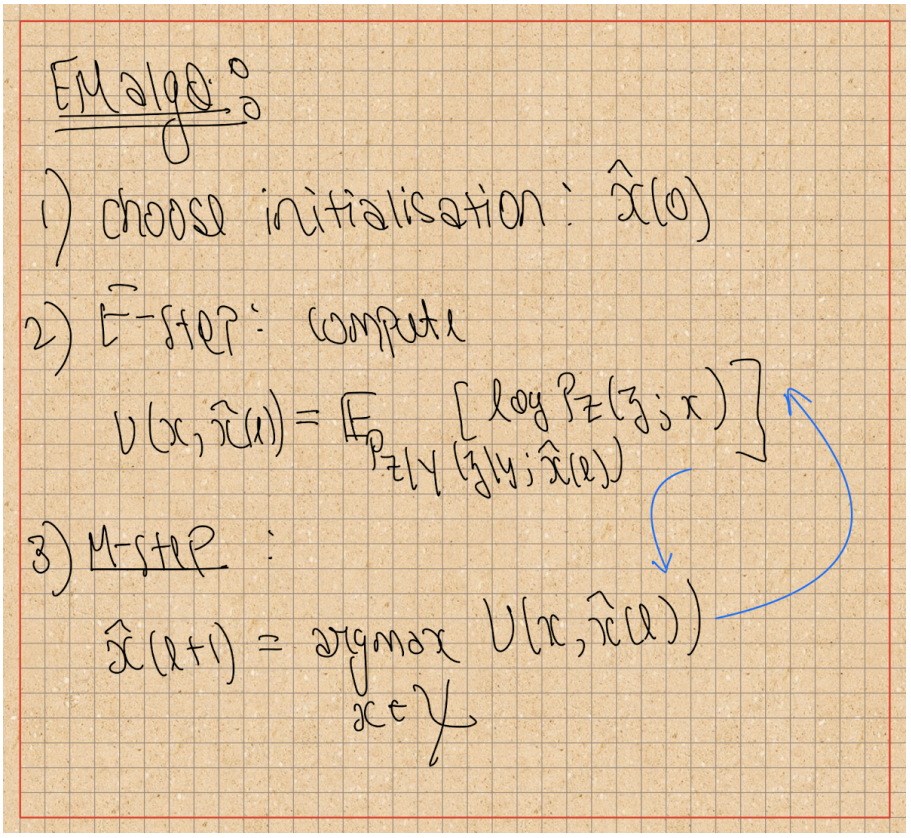
Apply the robust optimization framework to the Expectation-Maximisation algorithm and test its performance as compared with the regular approach.

2. Theoretical framework

a.



b.



c. Robustify the maximisation problem by considering different kinds of uncertainty sets and try to derive tractable formulations to solve the problem
d. Will work specifically for the case of Mixture of Gaussian models, where each data point is chosen randomly from a given set of gaussian distributions with different parameters.

$z = (y, c) : Z\ is\ complete\ data\ containing\ the\ data\ point\ as\ well\ as\ the\ class\ it\ belongs\ to.\ Only\ y\ is\ observ$

$P(z\ ;\ x) = \sum_{c=1}^{k} p_c.\ N(y\ ;\ \mu_c,\ \sigma_c)$ and given data want to estimate p_c, μ_c and σ_c

3. Testing on data
    a. Begin by constructing a synthetic dataset with known statistical distributions and testing our model's performance on it
    b. Once more confident in our model, test in an area where the EM algorithm is currently used in literature, (e.g. Robotics AI, NLP, Speech Recognition, Computer Vision, Decoding Hidden Markov Models) and implement our robust algorithm to (hopefully) observe improvement.