NIH Portfolio Optimization

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February 25, 2019

Abstract

The code can be found in this Github Repository NIH_Portfolio. [1]

[1] https://github.com/ieshaw/NIH_Portfolio

Contents

1 Introduction

1.1 Problem Description

2 Literature Review

2012

This investigation is meant as an extension of the work of Andrew Lo et. al in *Estimating the NIH Efficient Frontier*[1]. This work applied the work of Markowitz's portfolio optimization [3] to the 7 groups of disease-oriented NIH institutes. We pick up the investigation, investigating the more granular level of individual grants. They found that the years of life lost (YLL) could be expected to decrease if their approach was adopted by funding authorities, but acknowledged the policy and cultural shifts necessary could be less than palatable.

2017

Keeping in mind the quantitatively supported thesis of Katz and Matter's report on the current and forward looking inequality of research funding by the NIH [2], we make conscience effort to not favor or disfavor established principal investigators (PI's).

Data

Our Data was collected from the following links:

1. Estimates of Funding for Various Research, Condition, and Disease Categories (RCDC):
   `https://report.nih.gov/categorical_spending.aspx`
2. Appropriations by Institute:
   `https://www.nih.gov/about-nih/what-we-do/nih-almanac/appropriations-section-1`

3 Analysis

Mean-Variance Portfolio optimization takes the form

$$\begin{aligned} \min_{X} \quad & X^T \Sigma X \\ \text{subject to} \quad & X^T \mu \geq \mu_0 \\ & X \bullet 1 = 1 \\ & X \geq 0 \end{aligned}$$

With the terms defined as

$$\begin{aligned} n &= \text{ number of assets} \\ \Sigma &= \text{ co-variance of assets }, \in \mathbb{R}^{n \times n} \\ \mu &= \text{ expected return vector}, \in \mathbb{R}^{n \times 1} \\ \mu_0 &= \text{ expected return of portfolio, to be varied in analysis}, \in \mathbb{R}^{n \times 1} \end{aligned}$$

In 2012 Lo et. al. proposed setting the correlation matrix (necessary for constructing the covariance matrix Σ) based on ROI Correlation. Our proposed addition to the body of work is to develop correlation on a min-max regularization of the cosine similarity of citation and mutual citation.

4 Proposed Solution

5 Future Work

Appendices

A Keep Math Here?

References

[1] A. Lo D. Bisias and J. Watkins. Estimating the nih efficient fronteir. *PLoS ONE*, 7, May 2012.

[2] Y. Katz and Ulrich Matter. On the biomedical elite: Inequality and stasis in scientific knowledge production. *Berkman Klein Center for Internet & Society Research Publication*, 2017. `http://nrs.harvard.edu/urn-3:HUL.InstRepos:33373356`.

[3] H. Markowitz. College admissions and the stability of marriage. *Journal of Finance*, 7:77–91, 1952.