Notes

Unit vector of direction to manifold.

$$X_{t+1} = AX_t + BN_t$$

$$\begin{aligned}\mathbb{E}X_{t+1}X_{t+1}^T &= \mathbb{E}(AX_t + BN_t)(AX_t + BN_t)^T \\ &= A\mathbb{E}X_tX_t^TA^t + B\mathbb{E}N_tN_t^T\end{aligned}$$

where we use $\mathbb{E}N_t = 0$ and the independence of X_t and N_t. Then $N_tN_t^T = I$ gives

$$\Sigma_{t+1} = A\Sigma_tA^T + B$$

$$\Sigma = AXX^T + BNX$$

The plane of attraction is spanned by the eigenvectors corresponding to non-negative eigenvalues of A.

So look given X_t the investment balance is given by

$$v = (P - I)X_t$$

be the vector which points

Can we define an investment functional?

Let W be a window value. We define input matrices

$$[X_{t-W+1}| \dots |X_t]$$

which we flatten and feed into an RNN or LSTM with the output X_{t+1}.

Given the correlation between the stock price returns we will first want to perform a dimension reduction.

Next we will not predict prices but instead returns. We define the return at time t for the i-th asset as

$$r_i(t) = \frac{x_i(t) - x_i(t-1)}{x_i(t-1)}$$

and we define the return vector R_t as the column vector with entries r_t^i. We first produce a dimension reduction on R_t. We can try out a variety of techniques from PCA to autoencoder.