Power Method

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This method is used to find the largest eigenvalue and corresponding eigenvector for a matrix $A_{n\times n}$, often called the first eigenvalue.

Let $\{\lambda_i\}_{i=1}^{n}$ be the eigenvalues of A with the corresponding eigenvectors being $\{X_i\}_{i=1}^{n}$ This method is only applicable if all the eigenvectors are linearly independent of each other. So that

$$X = \sum_{i=1}^{n} c_i X_i$$

We take an arbitrary initial vector called $X_{n\times 1}^{(0)}$ and find $AX^{(0)}$. Then factor out the largest number from the resultant matrix, call it $\lambda^{(0)}$.

$$AX^{(0)} = \lambda^{(0)} X^{(1)}$$

Now find $AX^{(1)}$ and factor out the largest number called $\lambda^{(1)}$ to leave $X^{(2)}$.

Generally:

$$AX^{(k)} = \lambda^{(k)} X^{(k+1)}$$

We stop when $X^{(r-1)} \approx X^{(r)}$. Then $\lambda^{(r)}$ is the largest eigenvalue and $X^{(r)}$ the corresponding eigenvector