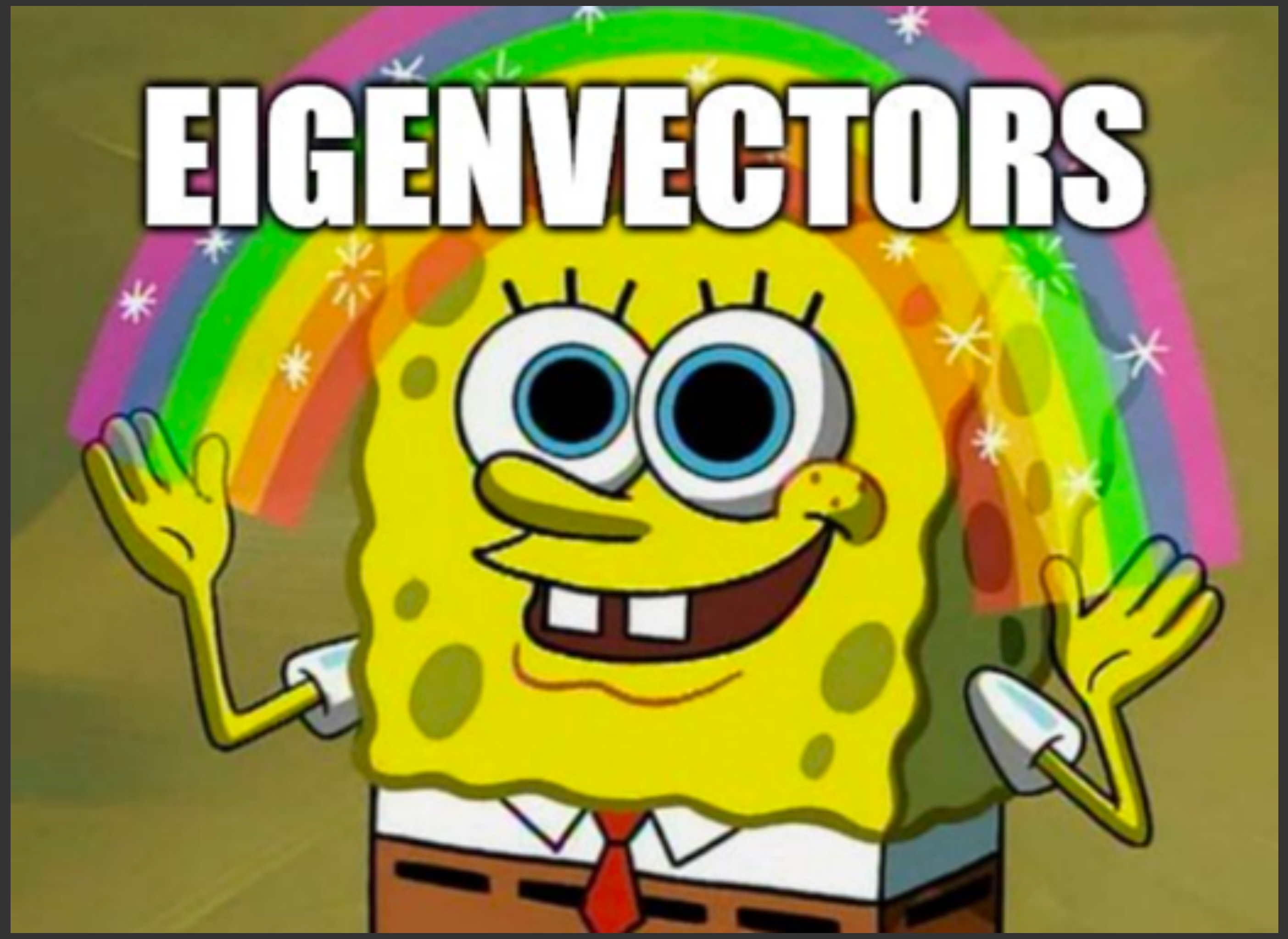
eigenvalue decomposition summarized

- Let $\vec{v}_1, \vec{v}_2, \ldots, \vec{v}_n$ be the eigenvectors of matrix A and let $\lambda_1, \lambda_2, \ldots, \lambda_n$ be corresponding eigenvalues
- Consider now a matrix Q whose columns are $\vec{v}_1, \vec{v}_2, \ldots, \vec{v}_n$
- We have now

$$
\begin{aligned}
AQ = A \begin{bmatrix} | & | & | & | \\ \vec{v_1} & \vec{v_2} & \ldots & \vec{v_1} \\ | & | & | & | \end{bmatrix} &= \begin{bmatrix} | & | & | & | \\ A\vec{v_1} & A\vec{v_2} & \ldots & A\vec{v_1} \\ | & | & | & | \end{bmatrix} \\
&= \begin{bmatrix} | & | & | & | \\ \lambda_1\vec{v_1} & \lambda_2\vec{v_2} & \ldots & \lambda_n\vec{v_1} \\ | & | & | & | \end{bmatrix}
\end{aligned}
$$



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$$= \begin{bmatrix} | & | & | & | \\ \lambda_1\vec{v_1} & \lambda_2\vec{v_2} & \ldots & \lambda_n\vec{v_1} \\ | & | & | & | \end{bmatrix}$$

$$= \begin{bmatrix} | & | & | & | \\ \vec{v_1} & \vec{v_2} & \ldots & \vec{v_1} \\ | & | & | & | \end{bmatrix} = \begin{bmatrix} \lambda_1 & 0 & \ldots & 0 \\ 0 & \lambda_2 & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \ldots & \lambda_n \end{bmatrix} = QD$$