Writing Exercise

Bochen Wang
Tianyuan Liu

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1 Exercise 4.1

1.1

$$\max_{a}\{a^T B a\}$$
$$\text{s.b.t } a^T W a = 1$$

corresponding to the lagrangian

$$
\begin{aligned}
L_P &= a^T B a - \lambda(a^T W a - 1) \\
\text{Let } \frac{\partial L_P}{\partial a} &= 2Ba - 2\lambda W a = 0 \\
W^{-1} B a &= \lambda a
\end{aligned}
$$

$\therefore$ a is a eigenvector of $W^{-1}B$

$$
\begin{aligned}
\because Ba &= \lambda W a \\
\therefore a^T B a &= \lambda a^T W a \\
\because a^T W a &= 1 \\
\therefore a^T B a &= \lambda
\end{aligned}
$$

$\therefore$ a is the eigenvector corresponding to the biggest eigenvalue of $W^{-1}B$