Mini Project 2 - Deep Learning

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Question 2

$$
\begin{aligned}
W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmin}} ||WX - Y||_F \\
\iff W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmin}} \langle WX - Y | WX - Y \rangle \\
\iff W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmin}} ||WX||^2 + ||Y||^2 - 2\langle WX | Y \rangle \\
\iff W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmax}} \langle WX | Y \rangle \\
\iff W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmax}} \langle W | YX^T \rangle \\
\iff W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmax}} \langle W | U\Sigma V^T \rangle \\
\iff W^* &= \underset{W \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmax}} \langle U^T W V | \Sigma \rangle \\
\iff W^* &= U \underbrace{\underset{W' \in \mathcal{O}_d(\mathbb{R})}{\operatorname{argmax}} \langle W' | \Sigma \rangle}_{Id} V^T \\
\iff W^* &= UV^T
\end{aligned}
$$