\begin{figure}

\begin{center}

\includegraphics[scale=1.70]{img/fisherfaces/sample\_images}

\captionof{figure}{These are the scatter matrices.}

\label{fig:scatter\_matrices}

\end{center}

\end{figure}

\begin{eqnarray}

X & = & \{X\_1,X\_2,\ldots,X\_c\} \\

X\_i & = & \{x\_1, x\_2, \ldots, x\_n\}

\end{eqnarray}

% between-classes scatter

\begin{eqnarray}

\label{eqn:scatter\_matrices}

S\_{B} & = & \sum\_{i=1}^{c} N\_{i} (\mu\_i - \mu)(\mu\_i - \mu)^{T} \\

S\_{W} & = & \sum\_{i=1}^{c} \sum\_{x\_{j} \in X\_{i}} (x\_j - \mu\_i)(x\_j - \mu\_i)^{T}

\end{eqnarray}

\begin{equation}

\mu = \frac{1}{N} \sum\_{i=1}^{N} x\_i

\end{equation}

% Class-Average

\begin{equation}

\mu\_i = \frac{1}{|X\_i|} \sum\_{x\_j \in X\_i} x\_j

\end{equation}

W\_{opt} = \operatorname{arg\,max}\_{W} \frac{|W^T S\_B W|}{|W^T S\_W W|}

\end{equation}

\begin{eqnarray}

\label{eqn:general\_eigenwert}

S\_{B} v\_{i} & = & \lambda\_{i} S\_w v\_{i} \nonumber \\

S\_{W}^{-1} S\_{B} v\_{i} & = & \lambda\_{i} v\_{i}

\end{eqnarray}

\begin{eqnarray}

W\_{pca} & = & \operatorname{arg\,max}\_{W} |W^T S\_T W| \\

W\_{fld} & = & \operatorname{arg\,max}\_{W} \frac{|W^T W\_{pca}^T S\_{B} W\_{pca} W|}{|W^T W\_{pca}^T S\_{W} W\_{pca} W|}

\end{eqnarray}

\begin{equation} \label{eqn:fisherfaces}

W = W\_{fld}^{T} W\_{pca}^{T}

\end{equation}