\section{Classifier Fusion}

Often certain classifiers will perform better than others in certain aspects. To exploit the best-performing attributes of multiple classifiers, the classifiers may be \textit{fused} together. There are multiple methods available to perform this task, but for this project, Na\"{i}ve Bayesian classifier fusion was performed. Given a set of predicted labels produced by classifier \textit{k}, $\bm{s}\_{k}$, the ``fused'' label may be estimated by applying Bayes' Theorem:

\begin{equation}

P(\omega\_{k}|\bm{s}) = \frac{p(\bm{s}|\omega\_{k})}{p(\bm{s})}=\frac{P(\omega\_{k})\prod\_{i=1}^{L}p(s\_{i}|\omega\_{k})}{p(\bm{s})}

\end{equation}

where $P(\omega\_{k})= \frac{N\_{k}}{N}$ is the prior probability of class $\omega\_{k}$, $N\_{k}$ is the number of samples in class $\omega\_{k}$, $N$ is the total number of samples, $p(s\_{i}|\omega\_{k})=\frac{cm\_{k,s\_{i}}}{N\_{k}}$ is the pdf of predicted labels from classifier $i$ belonging to class $\omega\_{k}$, and $cm\_{k,s\_{i}}$ is the confusion matrix for classifier $i$ at row $k$. The above equation may be approximated with \cite{qi2}

\begin{equation}

P(\omega\_{k}|\bm{s})\approx \frac{1}{N\_{k}^{L-1}}\prod\_{i=1}^{L}cm\_{k, s\_{i}}

\end{equation}

\section{Classifier Fusion Results}

\textbf{\*\*\*Not much to say here other than that when fusing results of the BPNN (0.49 MCC) and the Random Forest classifier (0.55 MCC), the resulting MCC value was 0.47 - leading us to believe that classifier fusion was NOT helpful in improving the performances from these two classifiers.\*\*\*}