### 4.3. Discussion

Based on the robustness and collision performance results of the 3 proposed methods to create 56-bit fingerprint codewords, we can make the following observations. All three methods have better collision performance than the baseline method with 36-bit fingerprint codewords. this goes to show that in order to support large scale media databases it is useful to derive longer fingerprint codewords. Method 1 which uses 56 projection matrices and derives 1 bit from each projected value, performs the best in terms of collision but performs the worst in terms of robustness. Method 2 has similar robustness performance as the baseline method and has similar collision performance as Method 1. Therefore, Method 2 maintains the robustness of the baseline method while improving the collision performance significantly. Method 2 provides the best trade-off between collision performance and robustness. Method 3 doesn't perform as well as the other two methods either in terms of robustness or in terms of collision. The meta-features seem to be highly correlated and this could be the reason that Method 3's collision performance is a lot worse than those of the other two methods(M1 and M2).

## 5. CONCLUSION

In this paper, we proposed three methods to derive longer fingerprint codewords from a feature matrix so as to increase the range space of the hash function. We consider the projections based hash method in [1] (which has an effective range space of $2^{22}$) as the baseline method and increase its range space to $2^{34}$. The first method derives more fingerprint bits by projecting the feature matrix onto more projection matrices. It derives one bit from each projected value as in [1]. The second method uses the same set of projection matrices as in [1] but derives more fingerprint bits by quantizing certain robust projections using 4 levels and others using 2 quantization levels. The third method also uses the same set of projection matrices as in [1] but derives additional bits by creating more features that capture the relationships between the projected values. We compare the performance of these three methods in terms of robustness and sensitivity with the performance of the baseline method in [1]. Based on experimental results, we conclude that method 2 provides the best trade-off between collision performance and robustness. All 3 methods have better collision performance than the baseline method as the effective range space of the proposed methods with longer fingerprint codewords is $2^{34}$.

## 6. REFERENCES


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