

APPENDIX

Adapting the Chumbley Score to match striae on Land Engraved Areas (LEAs) of bullets

June 28, 2018

Appendix

A Scenarios of failed tests

Figures 1 and 2 show scenarios in which the deterministic Chumbley score can fail. In Figure 1 both CS1 and CS2 fail, because the lag between optimal locations is so large that no same-shift pairs can be found once the signatures are aligned. These failures are inherent to the Chumbley Score and cannot be prevented.

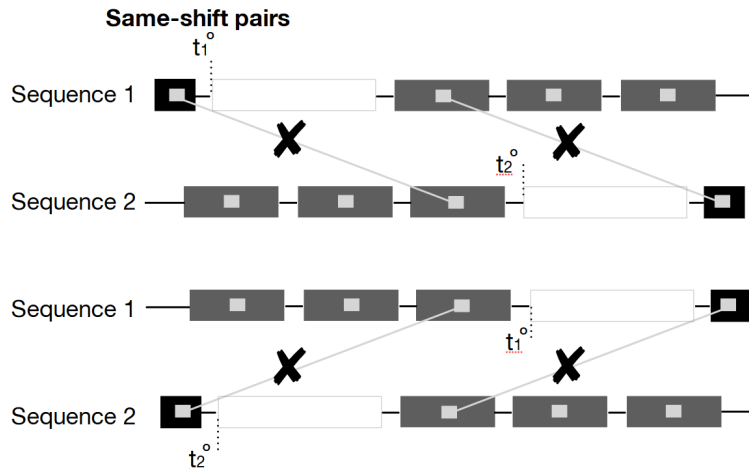


Figure 1: Sketch of same-shift pairings. When the lag between optimal reference points is too large to accommodate a validation window in both signatures, both CS1 and CS2 fail.

Figure 2 shows two situations, in which CS1 fails to identify any different-shift pairings. This happens, when both relative locations are close to either end of the signature. CS2 can still be computed in this situation as long as there are at least two same-shift pairs identified.

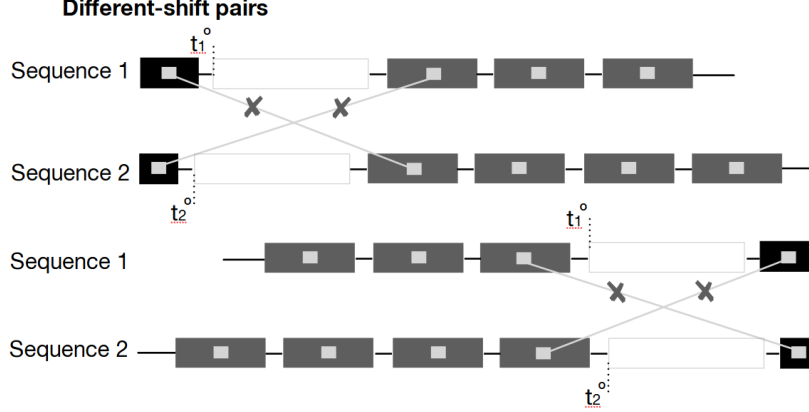


Figure 2: Sketch of different-shift pairings. For CS1 no different-shift pairs can be identified, resulting in a failed test.

B Type 2 errors: CS1 vs CS2

Figure 3 gives an overview of type 2 error rates of methods CS1 and CS2 for different significance levels α . Method CS2 is outperforming CS1 significantly in every instance.

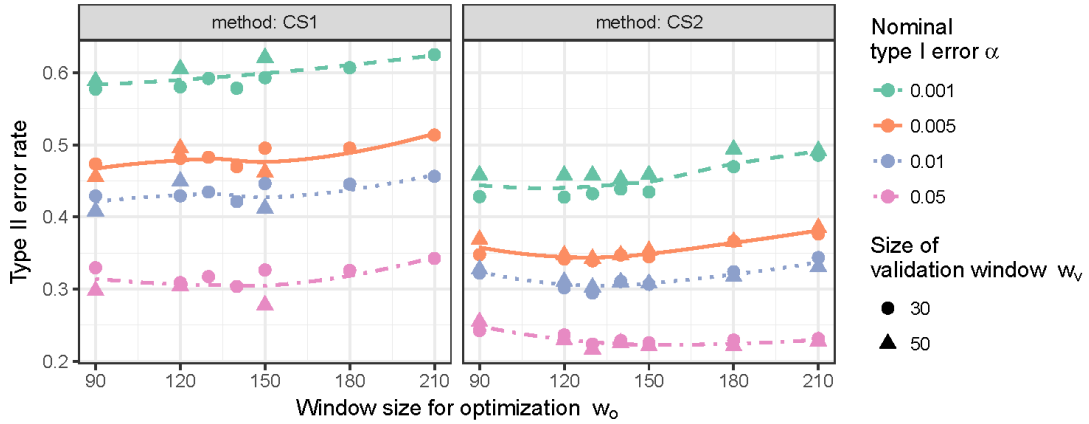


Figure 3: Type II error rates observed across a range of window sizes for optimization w_o . For a window size of $w_o = 130$ we see a minimum in type II error rate across all type I rates considered. Smaller validation sizes w_v are typically associated with a smaller type II error.