



SPONSORED BY THE



# Deep Text Anonymisation

Axel Adrian Bao Minh Doan Dang Stephanie Evert Philipp Heinrich Leonardo Zilio  
Lucca Baumgärtner Michael Keuchen Jannick Preiwisch Melanie Rosa Julian Werner

| Project info: AnGer  | Laws about technologies  | Annotation guidelines  | Challenge and solutions |                         |           |                     |                  |   |   |      |               |                              |  |      |                  |  |  |      |  |
|--|--|--|-------------------------|-------------------------|-----------|---------------------|------------------|---|---|------|---------------|------------------------------|--|------|------------------|--|--|------|--|
| <p><b>Anonymisierung von Gerichtsentscheidungen für die digitale Justiz</b><br/><b>Automatic Anonymisation and Pseudonymisation of Court Decisions</b></p> <p>Prof. Dr. Stephanie Evert<br/>1 Computational Corpus Linguistics<br/>Prof. Dr. Axel Adrian<br/>2 Legal Theory and Legal Design</p> <p><b>Team</b><br/>Bao Minh Doan Dang<sup>1</sup>, Philipp Heinrich<sup>1</sup>, Michael Keuchen<sup>2</sup>, Melanie Rosa<sup>2</sup>, Julian Werner<sup>2</sup>, Leonardo Zilio<sup>1</sup><br/>... and many student assistants</p> <p><b>Quick facts</b></p> <ul style="list-style-type: none"> <li>very few court decisions (&lt; 3%) are currently made publicly available in Germany</li> <li>key reason: manual anonymisation too expensive</li> <li>our goal: fully automatic high-quality anonymisation using pre-trained large language models (LLM)</li> <li>deep text anonymisation = not just direct identifiers (name, company, address, telephone, ...) but also salient quasi-identifiers (job, medical conditions, ...)</li> <li>realistic pseudonymisation (vs. redaction or initials) preserves natural flow of text → text mining</li> <li>focus of AnGer on German court decisions, but can be fine-tuned to other text types and languages</li> <li>specialisation on district courts + high-quality gold standard results in &gt; 99% recall on high-risk spans</li> </ul> | <ul style="list-style-type: none"> <li>EU AI act → requirements for automatic anonymisation</li> <li>Adrian/Evert/Heinrich/Keuchen (2024): <b>Auslegung des KI-VO-E zur Evaluation von Verfahren der künstlichen Intelligenz am Beispiel der automatischen Anonymisierung von Gerichtsentscheidungen</b>. In <i>Proceedings of IRIS 2024. LexisNexis Best Paper Award</i>.</li> </ul> <p><b>Application of laws through technologies</b></p> <ul style="list-style-type: none"> <li>Fundamental right: <b>informational self-determination</b></li> <li>GDPR (General Data Protection Regulation) → personal data</li> <li>§ 30 AO (German Fiscal Code) → tax secrecy</li> <li>Trade Secrets Act, Corporate Personality Right</li> <li>§§ 203 et seq. of the German Criminal Code; §§ 17 et seq. of the German Unfair Competition Act → trade secrecy</li> <li>§ 30a AO (old version) → banking secrecy (abolished)</li> <li>§ 35 SGB I (German Social Security Code) → social secrecy</li> </ul> <p><b>Laws in the texts</b></p> <ul style="list-style-type: none"> <li>landlord-tenant law (district court)</li> <li>traffic law (district court)</li> <li>various legal domains (higher regional court)</li> <li>...</li> </ul> | <p><b>Annotation guidelines</b></p> <table border="1"> <tr> <th>Label</th> <th>Beschreibung / Hinweise</th> <th>Beispiele</th> <th>Informationshaltung</th> </tr> <tr> <td>Geschäftszeichen</td> <td>Alten- und Geschäftszeichen in der Gerichtsentscheidung</td> <td>Positiv: Flurnummern, Registernummern, Urkundennummern, GZ, Geschäftsjahr</td> <td>Nein</td> </tr> <tr> <td>Geschäftsname</td> <td>Nicht geschäftliches Akronym</td> <td></td> <td>Nein</td> </tr> <tr> <td>Geschäftsadresse</td> <td></td> <td></td> <td>Nein</td> </tr> </table> <p><b>Richtlinien für die Pseudonymisierung von Gerichtsentscheidungen – OLG</b><br/>Version 6, Stand 31.08.2023</p> <p><b>A. Übergeordnete Ziele bei der Pseudonymisierung</b></p> <ol style="list-style-type: none"> <li>An erster Stelle steht der Schutz der berechtigten Interessen aller Beteiligten und Betroffenen in den annotierten Gerichtsentscheidungen. Durch die Pseudonymisierung muss mit einer Sicherheit grenzender Wahrscheinlichkeit gewährleistet sein, dass die ursprünglich direkt wie indirekt beschriebenen Personen nicht mehr identifizierbar sind. Ergibt sich Zweifelsfälle oder Konflikte mit den weiteren nachfolgenden Zielen, so steht diese Regel nach einem möglichst maximalen Schutz an erster Stelle.</li> <li>Als zweites gilt es einen möglichst realistischen und vergleichbaren Urteilsdatensatz zu erstellen. Dieser soll die natürlichen Eigenarten, Besonderheiten in der Schreibweise, dem Auftreten von Merkmalen, aber auch typische Fehler, wie Schreibfehler enthalten.</li> <li>Weiter müssen die Pseudonyme konsistent über die gesamte Entscheidung eingesetzt werden. Der Datensatz soll nach der Pseudonymisierung weiterhin die logische Konsistenz und Verknüpfungen enthalten. Einem durchschnittlichen Leser sollte nicht auffallen, dass der Datensatz einer Pseudonymisierung unterzogen wurde.</li> <li>Des Weiteren sollen die pseudonymisierten Entscheidungen zu keiner anderen rechtlichen Bewertung führen als dies bei den ursprünglichen Entscheidungen der Fall ist. Durch die Pseudonymisierung soll möglichst keine Veränderung der Rechtslage herbeigeführt werden, die zu einer anderen Entscheidung führen. Die pseudonymisierten Entscheidungen sollten daher auch in rechtlicher Hinsicht logisch und konsistent sein.</li> </ol> <p><b>B. Vorgehensweise bei der Wahl der Pseudonyme für die einzelnen Merkmalskategorien (Labels aus der Annotation)</b></p> <ol style="list-style-type: none"> <li>Natürliche Personen       <ol style="list-style-type: none"> <li>Namen: Vor- und Nachnamen werden mit Hilfe der Vorschläge aus den Nomenalisten für natürliche Personen ersetzt. Auch die Reihenfolge Vorname NACHNAME oder NACHNAME, Vorname usw. wird beibehalten. Nachnamen werden durch Nachnamen und Vornamen durch Vornamen ersetzt. Bei der Auswahl der Namen aus den Listen wird versucht, die ethnische Namensherkunft beizubehalten. Demnach ist zu beachten, dass die gewählten Kombinationen aus Vor- und Nachnamen realistisch klingen. Gleiches gilt auch für Namensstrukturen, wie Doppelnamen.</li> </ol> </li> </ol> | Label                   | Beschreibung / Hinweise | Beispiele | Informationshaltung | Geschäftszeichen | Alten- und Geschäftszeichen in der Gerichtsentscheidung | Positiv: Flurnummern, Registernummern, Urkundennummern, GZ, Geschäftsjahr | Nein | Geschäftsname | Nicht geschäftliches Akronym |  | Nein | Geschäftsadresse |  |  | Nein | <p><b>Challenge</b></p> <ul style="list-style-type: none"> <li>legal obligation of courts to publish verdicts in an anonymised version</li> <li>ca. 1.5 million verdicts per year in Germany</li> <li>consequence: only fully automated batch processing scales to all verdicts</li> <li>rigorous quality control: even 1% error rate could result in 15,000 leaks / year</li> </ul> <p><b>Existing solutions: semi-automatic</b></p> <ul style="list-style-type: none"> <li>A-Tool by BALO.AI (anonymization solutions for courts in Switzerland)</li> <li>MAPA (Multilingual Anonymization for Public Administrations, EU project)</li> <li>OpenRedact (BMFB Prototype Fund)</li> <li>HILANO (BMFB kmu-Innovativ)</li> <li>JANO (IBM for Hessen/Baden-Württemberg)</li> </ul> <p><b>Our system</b></p> <ul style="list-style-type: none"> <li>currently probably the only fully automatic system with sufficient quality</li> <li>gold standard with extremely high annotation quality (virtually error-free!)</li> <li>realistic pseudonymisation → HPC training</li> <li>high degree of specialisation (e.g. tenancy cases in district courts) → excellent recall</li> </ul> |
| Label  | Beschreibung / Hinweise  | Beispiele  | Informationshaltung     |                         |           |                     |                  |   |   |      |               |                              |  |      |                  |  |  |      |  |
| Geschäftszeichen   | Alten- und Geschäftszeichen in der Gerichtsentscheidung  | Positiv: Flurnummern, Registernummern, Urkundennummern, GZ, Geschäftsjahr  | Nein                    |                         |           |                     |                  |   |   |      |               |                              |  |      |                  |  |  |      |  |
| Geschäftsname  | Nicht geschäftliches Akronym   |  | Nein                    |                         |           |                     |                  |   |   |      |               |                              |  |      |                  |  |  |      |  |
| Geschäftsadresse   |  |  | Nein                    |                         |           |                     |                  |   |   |      |               |                              |  |      |                  |  |  |      |  |

| Raw text | Detection of sensitive text spans | Pseudonymised text |
|----------|-----------------------------------|--------------------|
|          |                                   |                    |

| Experiments with automatic anonymisation  | Results: Named-entity recognition   |                        |                       |                        |               |                        |                       |               |                       |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
|---|---|------------------------|-----------------------|------------------------|---------------|------------------------|-----------------------|---------------|-----------------------|---------|--|---------|-----------|--------|----------|-----------|--------|----------|-----------|--------|----------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|--------------|--------------|------------------------|-----------------------|--------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|
| <p><b>Large language models (LLMs)</b></p> <ul style="list-style-type: none"> <li>Three different LLMs were tested in anonymisation experiments:           <ul style="list-style-type: none"> <li>GottBert (Scheible et al. 2020)</li> <li>XLM-Roberta<sub>large</sub> (Conneau et al. 2019)</li> <li>XLM-V<sub>base</sub> (Liang et al. 2023)</li> </ul> </li> <li>GottBert is a German LLM that is currently being used in the anonymisation tool</li> <li>GottBert was trained as a multi-task learning (MTL) model: detects different layers simultaneously</li> <li>XLM-R and XLM-V are multilingual models that include German and were trained for NER</li> </ul> <p><b>Dataset</b></p> <ul style="list-style-type: none"> <li>The dataset consists of 570 verdicts issued by district courts (AG) in Bavaria, Germany</li> <li>50% of the dataset was used for training, 25% for validation, and the remaining 25% for testing</li> </ul> <p><b>Training</b></p> <ul style="list-style-type: none"> <li>GottBert MTL was trained over 5 epochs and approximately 6 minutes</li> <li>XLM-Roberta<sub>large</sub> was trained over 13 epochs and approximately 1 hour and 28 minutes</li> <li>XLM-V<sub>base</sub> was trained over 39 epochs and approximately 4 hours and 16 minutes</li> </ul> <p><b>Discussion</b></p> <ul style="list-style-type: none"> <li>The result tables on the right show a strict evaluation of detected spans: a span is only considered correct if all its tokens are correctly recognised</li> <li>GottBert and XLM-Roberta<sub>large</sub> achieved the best scores in most cases for NER, especially in terms of recall, which is the most important criterion for our anonymisation task</li> <li>XLM-Roberta<sub>large</sub> was able to edge out GottBert by a small margin in terms of recall in anonymised spans, but at the cost of a few points in precision</li> <li>In spite of being the largest model, XLM-V was not able to outperform the other models, except for a few cases in the NER task</li> <li>When taking the risk of deanonimisation into account, all three models performed very well, coming close to or even surpassing 99% of recall on high-risk text spans.</li> <li>Conclusion: these <b>fine-tuned LLMs can identify around 99% of the text spans that definitely need to be anonymised in the tested verdicts</b></li> <li>Although XLM-Roberta<sub>large</sub> had better results, it is a much larger model and took much longer time to train than GottBert, making GottBert still possibly the best choice for deployment.</li> </ul> | <table border="1"> <thead> <tr> <th rowspan="2">Entities</th> <th colspan="3">GottBert MTL</th> <th colspan="3">XLM-R<sub>large</sub></th> <th colspan="3">XLM-V<sub>base</sub></th> <th rowspan="2"># Spans</th> </tr> <tr> <th>Precision</th> <th>Recall</th> <th>F1-score</th> <th>Precision</th> <th>Recall</th> <th>F1-score</th> <th>Precision</th> <th>Recall</th> <th>F1-score</th> </tr> </thead> <tbody> <tr> <td>address-idx</td> <td>0.6583</td> <td>0.5852</td> <td>0.6196</td> <td>0.6109</td> <td>0.6630</td> <td>0.6359</td> <td>0.4957</td> <td>0.6407</td> <td>0.5590</td> <td>270</td> </tr> <tr> <td>address-name</td> <td>0.9718</td> <td>0.9773</td> <td>0.9745</td> <td>0.9675</td> <td>0.9651</td> <td>0.9663</td> <td>0.9751</td> <td>0.9554</td> <td>0.9651</td> <td>1232</td> </tr> <tr> <td>car-idx</td> <td>0.6630</td> <td>0.7531</td> <td>0.7052</td> <td>0.6019</td> <td>0.7840</td> <td>0.6810</td> <td>0.6114</td> <td>0.7284</td> <td>0.6648</td> <td>162</td> </tr> <tr> <td>car-name</td> <td>0.9846</td> <td>1.0000</td> <td>0.9922</td> <td>0.9688</td> <td>0.9688</td> <td>0.9688</td> <td>0.9846</td> <td>1.0000</td> <td>0.9922</td> <td>64</td> </tr> <tr> <td>court-docket</td> <td>0.9721</td> <td>0.9924</td> <td>0.9821</td> <td>0.9697</td> <td>0.9734</td> <td>0.9715</td> <td>0.9774</td> <td>0.9886</td> <td>0.9830</td> <td>526</td> </tr> <tr> <td>court-name</td> <td>0.9984</td> <td>0.9968</td> <td>0.9976</td> <td>0.9937</td> <td>0.9953</td> <td>0.9945</td> <td>0.9921</td> <td>0.9921</td> <td>0.9921</td> <td>634</td> </tr> <tr> <td>date-fact</td> <td>0.9358</td> <td>0.9437</td> <td>0.9397</td> <td>0.9341</td> <td>0.9628</td> <td>0.9482</td> <td>0.9330</td> <td>0.9321</td> <td>0.9326</td> <td>942</td> </tr> <tr> <td>date-world</td> <td>0.9681</td> <td>0.9523</td> <td>0.9601</td> <td>0.9776</td> <td>0.9437</td> <td>0.9603</td> <td>0.9606</td> <td>0.9502</td> <td>0.9553</td> <td>923</td> </tr> <tr> <td>jur-idx</td> <td>0.9630</td> <td>0.8966</td> <td>0.9286</td> <td>1.0000</td> <td>0.8966</td> <td>0.9455</td> <td>0.9630</td> <td>0.8966</td> <td>0.9286</td> <td>29</td> </tr> <tr> <td>jur-name</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td>6</td> </tr> <tr> <td>nat-idx</td> <td>0.9257</td> <td>0.9122</td> <td>0.9189</td> <td>0.9385</td> <td>0.8927</td> <td>0.9150</td> <td>0.8889</td> <td>0.8976</td> <td>0.8932</td> <td>205</td> </tr> <tr> <td>nat-jur</td> <td>0.5800</td> <td>0.6042</td> <td>0.5918</td> <td>0.5833</td> <td>0.7292</td> <td>0.6481</td> <td>0.3571</td> <td>0.6250</td> <td>0.4545</td> <td>48</td> </tr> <tr> <td>nat-name</td> <td>0.9946</td> <td>0.9946</td> <td>0.9946</td> <td>0.9964</td> <td>0.9964</td> <td>0.9964</td> <td>0.9910</td> <td>0.9946</td> <td>0.9928</td> <td>555</td> </tr> <tr> <td>nat-name</td> <td>0.9938</td> <td>0.9867</td> <td>0.9903</td> <td>0.9919</td> <td>0.9949</td> <td>0.9934</td> <td>0.9898</td> <td>0.9929</td> <td>0.9913</td> <td>980</td> </tr> <tr> <td><b>Micro avg</b></td> <td><b>0.9494</b></td> <td><b>0.9475</b></td> <td><b>0.9485</b></td> <td><b>0.9411</b></td> <td><b>0.9504</b></td> <td><b>0.9458</b></td> <td><b>0.9266</b></td> <td><b>0.9430</b></td> <td><b>0.9347</b></td> <td>6576</td> </tr> <tr> <td><b>Macro avg</b></td> <td><b>0.8292</b></td> <td><b>0.8282</b></td> <td><b>0.8282</b></td> <td><b>0.8239</b></td> <td><b>0.8404</b></td> <td><b>0.8303</b></td> <td><b>0.7943</b></td> <td><b>0.8281</b></td> <td><b>0.8075</b></td> <td>6576</td> </tr> <tr> <td><b>Weighted avg</b></td> <td><b>0.9483</b></td> <td><b>0.9475</b></td> <td><b>0.9477</b></td> <td><b>0.9448</b></td> <td><b>0.9504</b></td> <td><b>0.9471</b></td> <td><b>0.9357</b></td> <td><b>0.9430</b></td> <td><b>0.9385</b></td> <td>6576</td> </tr> </tbody> </table> <p>Table: Named-entity recognition on district court (AG) verdicts using three fine-tuned LLMs.</p> | Entities               | GottBert MTL          |                        |               | XLM-R <sub>large</sub> |                       |               | XLM-V <sub>base</sub> |         |  | # Spans | Precision | Recall | F1-score | Precision | Recall | F1-score | Precision | Recall | F1-score | address-idx | 0.6583 | 0.5852 | 0.6196 | 0.6109 | 0.6630 | 0.6359 | 0.4957 | 0.6407 | 0.5590 | 270  | address-name | 0.9718       | 0.9773                 | 0.9745                | 0.9675 | 0.9651 | 0.9663 | 0.9751 | 0.9554 | 0.9651 | 1232   | car-idx | 0.6630 | 0.7531 | 0.7052 | 0.6019 | 0.7840 | 0.6810 | 0.6114 | 0.7284 | 0.6648 | 162 | car-name | 0.9846 | 1.0000 | 0.9922 | 0.9688 | 0.9688 | 0.9688 | 0.9846 | 1.0000 | 0.9922 | 64 | court-docket | 0.9721 | 0.9924 | 0.9821 | 0.9697 | 0.9734 | 0.9715 | 0.9774 | 0.9886 | 0.9830 | 526 | court-name | 0.9984 | 0.9968 | 0.9976 | 0.9937 | 0.9953 | 0.9945 | 0.9921 | 0.9921 | 0.9921 | 634 | date-fact | 0.9358 | 0.9437 | 0.9397 | 0.9341 | 0.9628 | 0.9482 | 0.9330 | 0.9321 | 0.9326 | 942 | date-world | 0.9681 | 0.9523 | 0.9601 | 0.9776 | 0.9437 | 0.9603 | 0.9606 | 0.9502 | 0.9553 | 923 | jur-idx | 0.9630 | 0.8966 | 0.9286 | 1.0000 | 0.8966 | 0.9455 | 0.9630 | 0.8966 | 0.9286 | 29 | jur-name | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 6 | nat-idx | 0.9257 | 0.9122 | 0.9189 | 0.9385 | 0.8927 | 0.9150 | 0.8889 | 0.8976 | 0.8932 | 205 | nat-jur | 0.5800 | 0.6042 | 0.5918 | 0.5833 | 0.7292 | 0.6481 | 0.3571 | 0.6250 | 0.4545 | 48 | nat-name | 0.9946 | 0.9946 | 0.9946 | 0.9964 | 0.9964 | 0.9964 | 0.9910 | 0.9946 | 0.9928 | 555 | nat-name | 0.9938 | 0.9867 | 0.9903 | 0.9919 | 0.9949 | 0.9934 | 0.9898 | 0.9929 | 0.9913 | 980 | <b>Micro avg</b> | <b>0.9494</b> | <b>0.9475</b> | <b>0.9485</b> | <b>0.9411</b> | <b>0.9504</b> | <b>0.9458</b> | <b>0.9266</b> | <b>0.9430</b> | <b>0.9347</b> | 6576 | <b>Macro avg</b> | <b>0.8292</b> | <b>0.8282</b> | <b>0.8282</b> | <b>0.8239</b> | <b>0.8404</b> | <b>0.8303</b> | <b>0.7943</b> | <b>0.8281</b> | <b>0.8075</b> | 6576 | <b>Weighted avg</b> | <b>0.9483</b> | <b>0.9475</b> | <b>0.9477</b> | <b>0.9448</b> | <b>0.9504</b> | <b>0.9471</b> | <b>0.9357</b> | <b>0.9430</b> | <b>0.9385</b> | 6576 |
| Entities  | GottBert MTL  |                        |                       | XLM-R <sub>large</sub> |               |                        | XLM-V <sub>base</sub> |               |                       | # Spans |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
|   | Precision   | Recall                 | F1-score              | Precision              | Recall        | F1-score               | Precision             | Recall        | F1-score              |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| address-idx   | 0.6583  | 0.5852                 | 0.6196                | 0.6109                 | 0.6630        | 0.6359                 | 0.4957                | 0.6407        | 0.5590                | 270     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| address-name  | 0.9718  | 0.9773                 | 0.9745                | 0.9675                 | 0.9651        | 0.9663                 | 0.9751                | 0.9554        | 0.9651                | 1232    |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| car-idx   | 0.6630  | 0.7531                 | 0.7052                | 0.6019                 | 0.7840        | 0.6810                 | 0.6114                | 0.7284        | 0.6648                | 162     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| car-name  | 0.9846  | 1.0000                 | 0.9922                | 0.9688                 | 0.9688        | 0.9688                 | 0.9846                | 1.0000        | 0.9922                | 64      |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| court-docket  | 0.9721  | 0.9924                 | 0.9821                | 0.9697                 | 0.9734        | 0.9715                 | 0.9774                | 0.9886        | 0.9830                | 526     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| court-name  | 0.9984  | 0.9968                 | 0.9976                | 0.9937                 | 0.9953        | 0.9945                 | 0.9921                | 0.9921        | 0.9921                | 634     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| date-fact   | 0.9358  | 0.9437                 | 0.9397                | 0.9341                 | 0.9628        | 0.9482                 | 0.9330                | 0.9321        | 0.9326                | 942     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| date-world  | 0.9681  | 0.9523                 | 0.9601                | 0.9776                 | 0.9437        | 0.9603                 | 0.9606                | 0.9502        | 0.9553                | 923     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| jur-idx   | 0.9630  | 0.8966                 | 0.9286                | 1.0000                 | 0.8966        | 0.9455                 | 0.9630                | 0.8966        | 0.9286                | 29      |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| jur-name  | 0.0000  | 0.0000                 | 0.0000                | 0.0000                 | 0.0000        | 0.0000                 | 0.0000                | 0.0000        | 0.0000                | 6       |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| nat-idx   | 0.9257  | 0.9122                 | 0.9189                | 0.9385                 | 0.8927        | 0.9150                 | 0.8889                | 0.8976        | 0.8932                | 205     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| nat-jur   | 0.5800  | 0.6042                 | 0.5918                | 0.5833                 | 0.7292        | 0.6481                 | 0.3571                | 0.6250        | 0.4545                | 48      |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| nat-name  | 0.9946  | 0.9946                 | 0.9946                | 0.9964                 | 0.9964        | 0.9964                 | 0.9910                | 0.9946        | 0.9928                | 555     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| nat-name  | 0.9938  | 0.9867                 | 0.9903                | 0.9919                 | 0.9949        | 0.9934                 | 0.9898                | 0.9929        | 0.9913                | 980     |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| <b>Micro avg</b>  | <b>0.9494</b>   | <b>0.9475</b>          | <b>0.9485</b>         | <b>0.9411</b>          | <b>0.9504</b> | <b>0.9458</b>          | <b>0.9266</b>         | <b>0.9430</b> | <b>0.9347</b>         | 6576    |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| <b>Macro avg</b>  | <b>0.8292</b>   | <b>0.8282</b>          | <b>0.8282</b>         | <b>0.8239</b>          | <b>0.8404</b> | <b>0.8303</b>          | <b>0.7943</b>         | <b>0.8281</b> | <b>0.8075</b>         | 6576    |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| <b>Weighted avg</b>   | <b>0.9483</b>   | <b>0.9475</b>          | <b>0.9477</b>         | <b>0.9448</b>          | <b>0.9504</b> | <b>0.9471</b>          | <b>0.9357</b>         | <b>0.9430</b> | <b>0.9385</b>         | 6576    |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
|   | <p><b>Results: Anonymisation detection and recall on high-risk spans</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Sensitive spans</th> <th colspan="3">GottBert MTL</th> <th colspan="3">XLM-R<sub>large</sub></th> <th colspan="3">XLM-V<sub>base</sub></th> <th rowspan="2"># Spans</th> </tr> <tr> <th>Precision</th> <th>Recall</th> <th>F1-score</th> <th>Precision</th> <th>Recall</th> <th>F1-score</th> <th>Precision</th> <th>Recall</th> <th>F1-score</th> </tr> </thead> <tbody> <tr> <td></td> <td>0.9654</td> <td>0.9635</td> <td>0.9645</td> <td>0.9551</td> <td>0.9646</td> <td>0.9598</td> <td>0.9465</td> <td>0.9632</td> <td>0.9548</td> <td>6576</td> </tr> </tbody> </table> <p>Table: Anonymisation on district court (AG) verdicts using three fine-tuned LLMs.</p> <table border="1"> <thead> <tr> <th>Risk</th> <th>GottBert MTL</th> <th>XLM-R<sub>large</sub></th> <th>XLM-V<sub>base</sub></th> </tr> </thead> <tbody> <tr> <td>High</td> <td>0.9876</td> <td>0.9907</td> <td>0.9903</td> </tr> <tr> <td>Med</td> <td>0.9171</td> <td>0.8913</td> <td>0.8987</td> </tr> <tr> <td>Low</td> <td>0.9557</td> <td>0.9594</td> <td>0.9562</td> </tr> </tbody> </table> <p>Table: Recall for anonymisation of high-risk information on district court (AG) verdicts using three fine-tuned LLMs.</p>  | Sensitive spans        | GottBert MTL          |                        |               | XLM-R <sub>large</sub> |                       |               | XLM-V <sub>base</sub> |         |  | # Spans | Precision | Recall | F1-score | Precision | Recall | F1-score | Precision | Recall | F1-score |             | 0.9654 | 0.9635 | 0.9645 | 0.9551 | 0.9646 | 0.9598 | 0.9465 | 0.9632 | 0.9548 | 6576 | Risk         | GottBert MTL | XLM-R <sub>large</sub> | XLM-V <sub>base</sub> | High   | 0.9876 | 0.9907 | 0.9903 | Med    | 0.9171 | 0.8913 | 0.8987  | Low    | 0.9557 | 0.9594 | 0.9562 |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| Sensitive spans   | GottBert MTL  |                        |                       | XLM-R <sub>large</sub> |               |                        | XLM-V <sub>base</sub> |               |                       | # Spans |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
|   | Precision   | Recall                 | F1-score              | Precision              | Recall        | F1-score               | Precision             | Recall        | F1-score              |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
|   | 0.9654  | 0.9635                 | 0.9645                | 0.9551                 | 0.9646        | 0.9598                 | 0.9465                | 0.9632        | 0.9548                | 6576    |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| Risk  | GottBert MTL  | XLM-R <sub>large</sub> | XLM-V <sub>base</sub> |                        |               |                        |                       |               |                       |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| High  | 0.9876  | 0.9907                 | 0.9903                |                        |               |                        |                       |               |                       |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| Med   | 0.9171  | 0.8913                 | 0.8987                |                        |               |                        |                       |               |                       |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |
| Low   | 0.9557  | 0.9594                 | 0.9562                |                        |               |                        |                       |               |                       |         |  |         |           |        |          |           |        |          |           |        |          |             |        |        |        |        |        |        |        |        |        |      |              |              |                        |                       |        |        |        |        |        |        |        |         |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |    |              |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |           |        |        |        |        |        |        |        |        |        |     |            |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |   |         |        |        |        |        |        |        |        |        |        |     |         |        |        |        |        |        |        |        |        |        |    |          |        |        |        |        |        |        |        |        |        |     |          |        |        |        |        |        |        |        |        |        |     |                  |               |               |               |               |               |               |               |               |               |      |                  |               |               |               |               |               |               |               |               |               |      |                     |               |               |               |               |               |               |               |               |               |      |

| Annotation tool | Application to other text types: News article | Application to other text types: Telegram |
|-----------------|---|---|
|                 |   |   |