

Lang	Original	Rotation	FCNN	NVP	GBDD	Joint-Align	NORM	MUSE	MUSE+C	MUSE+G	MUSE+P	GNVP	GNVP+C	GNVP+G	GNVP+P	infoXLM	VecMap
<i>Reference-free Evaluation (m-BERT)</i>																	
cs-en	23.6	32.5	36.2	30.2	24.4	32.5	22.5	24.8	29.7	26.7	30.4	24.9	25.3	25.2	30.5	-	25.0
de-en	29.8	31.6	33.1	34.2	30.0	39.9	31.4	29.9	31.3	31.1	31.2	32.8	33.0	32.8	31.3	-	31.8
fi-en	30.9	48.5	51.3	51.8	32.5	48.6	32.3	37.9	44.0	40.4	46.0	37.2	39.5	37.9	46.1	-	39.1
lv-en	23.0	44.0	50.2	52.1	25.7	46.1	31.3	33.4	35.9	33.5	40.9	38.0	40.7	38.8	41.0	-	24.9
ru-en	19.4	23.4	30.7	33.4	21.4	31.7	23.9	19.8	22.0	21.3	22.9	26.5	27.0	26.3	22.9	-	18.7
tr-en	36.7	52.4	54.8	52.2	38.6	48.6	39.1	41.6	48.6	46.3	49.7	44.0	46.5	44.9	49.8	-	44.5
<i>Reference-free Evaluation (XLM-R)</i>																	
cs-en	20.6	26.3	26.1	32.9	22.4	-	28.0	20.4	24.2	22.3	24.6	29.2	30.1	29.1	25.1	26.6	-
de-en	25.1	27.4	28.2	40.5	25.4	-	39.5	25.2	26.5	26.0	26.6	40.4	40.4	40.5	27.2	37.3	-
fi-en	26.6	39.9	44.6	47.7	26.0	-	41.6	29.0	35.7	32.3	37.8	44.3	47.2	44.5	38.2	36.1	-
lv-en	28.3	42.3	48.6	51.2	29.6	-	44.1	30.8	37.9	32.7	40.7	47.3	48.7	47.4	40.9	38.3	-
ru-en	21.4	25.6	27.7	38.0	21.5	-	34.3	21.5	23.3	22.4	24.6	35.9	36.3	36.1	25.1	34.9	-
tr-en	36.5	46.5	44.8	54.7	37.9	-	49.6	38.4	44.7	41.2	45.9	53.2	52.9	51.7	46.2	52.6	-
<i>Tatoeba (m-BERT)</i>																	
cs-en	47.5	53.1	61.4	61.3	48.3	51.1	60.6	48.2	50.8	48.7	51.6	60.6	61.3	60.7	51.5	47.5	-
de-en	76.6	79.5	84.5	87.3	78.6	89.6	86.0	77.7	79.3	78.7	78.9	86.2	86.5	86.0	78.8	-	81.2
fi-en	41.5	50.6	57.2	54.3	46.4	70.4	53.5	44.7	46.5	45.2	47.8	53.9	56.1	54.6	47.5	-	53.5
lv-en	31.7	39.8	47.4	51.2	35.0	31.1	44.0	35.3	35.0	33.8	37.1	44.1	44.7	43.8	37.0	-	33.5
ru-en	63.0	65.7	70.3	72.6	64.8	74.2	75.4	63.5	64.9	64.7	66.3	75.1	76.0	75.1	66.3	-	66.5
tr-en	35.8	43.0	46.3	50.5	40.6	38.4	48.2	39.1	40.9	38.8	43.1	47.3	49.3	48.1	42.6	-	47.6
<i>Tatoeba (XLM-R)</i>																	
cs-en	49.8	57.5	74.6	72.9	59.2	-	72.5	53.8	58.9	60.6	59.1	72.8	74.0	73.3	57.6	69.6	-
de-en	89.0	91.0	94.5	94.9	90.1	-	95.2	88.7	91.0	89.6	90.8	94.6	95.2	94.8	90.5	95.5	-
fi-en	63.8	68.6	81.3	80.8	69.3	-	79.6	65.6	69.8	67.2	68.8	80.6	81.2	80.6	67.7	68.4	-
lv-en	52.2	61.3	72.6	72.4	58.9	-	71.9	56.4	63.1	59.2	61.0	71.5	71.5	71.7	59.7	51.2	-
ru-en	70.2	71.5	83.1	83.9	73.2	-	83.9	71.2	70.6	70.2	72.2	83.4	84.2	84.0	70.9	85.7	-
tr-en	55.4	61.7	75.1	75.6	62.4	-	75.4	58.6	62.0	63.2	61.0	75.1	76.9	75.7	61.3	86.1	-
<i>Contextual BLI (m-BERT)</i>																	
cs-en	47.3	52.6	49.2	52.3	47.7	57.0	50.1	47.7	50.0	48.4	50.8	51.8	52.0	51.5	51.0	-	55.1
de-en	61.0	64.6	59.0	63.8	60.9	79.4	63.3	61.8	61.8	62.1	62.5	64.8	64.8	64.7	63.0	-	71.7
fi-en	36.8	48.9	45.8	45.8	37.9	74.2	43.0	40.7	40.6	40.7	43.4	45.0	47.6	44.7	44.6	-	56.7
lv-en	42.7	51.8	49.5	50.6	43.5	49.8	47.9	45.5	44.5	45.9	48.7	49.9	50.5	49.7	49.5	-	53.9
ru-en	66.5	70.9	67.6	71.4	67.0	67.4	69.2	67.2	67.5	67.8	69.5	70.5	71.0	70.6	69.9	-	76.9
tr-en	51.1	61.9	60.7	61.8	51.5	60.2	55.8	52.0	52.8	53.7	56.4	60.2	62.1	58.7	58.3	-	70.4
<i>Contextual BLI (XLM-R)</i>																	
cs-en	40.2	45.1	43.6	51.1	39.3	-	48.2	41.6	42.0	41.5	42.3	49.8	50.0	49.6	43.3	50.7	-
de-en	54.1	57.9	53.2	64.6	54.3	-	62.7	55.2	55.1	55.3	55.4	65.1	65.3	64.9	56.3	67.3	-
fi-en	44.2	51.0	46.1	60.9	44.0	-	58.1	46.8	45.7	47.2	46.6	60.2	60.5	59.9	48.3	57.1	-
lv-en	44.2	50.0	48.3	57.6	44.2	-	54.8	46.4	45.7	47.3	46.5	56.9	57	56.7	47.8	53.5	-
ru-en	60.9	64.4	60.3	71.7	60.7	-	70.3	61.4	61.8	61.2	62.2	71.5	71.5	71.4	63.0	72.4	-
tr-en	47.9	53.6	53.8	63.9	48.0	-	60.1	48.6	48.5	48.6	49.2	62.5	63.1	62.5	50.9	64.0	-
<i>Word Alignment (m-BERT)</i>																	
cs-en	44.0	45.0	43.4	45.7	44.1	44.2	44.6	44.0	45.0	44.5	45.0	44.6	45.1	44.9	45.1	-	45.0
de-en	79.1	80.6	79.6	79.5	79.3	80.2	80.5	79.3	80.2	79.9	80.4	80.0	80.3	80.2	80.5	-	80.0
<i>Word Alignment (XLM-R)</i>																	
cs-en	41.1	42.1	41.8	45.2	40.9	-	44.4	41.2	42.1	41.8	42.1	44.6	44.9	44.8	42.0	43.3	-
de-en	78.5	79.6	77.9	80.5	78.7	-	80.8	78.8	78.9	79.2	79.1	81.0	81.4	81.2	79.0	82.6	-

Table 4: Full results of baselines and our approaches. Real-NVP and GAN-Real-NVP are denoted by NVP and GNVP. [Method]+P/C/G denotes the integration in Procrustes refinement (P), in our bootstrapping procedure constrained with cross-correlation (C) and with graph structure (G).