Bidirectional Generative Framework for Cross-domain Aspect-based Sentiment Analysis

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Code：https://github.com/DAMO-NLP-SG/BGCA

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Reported by Renhui Luo

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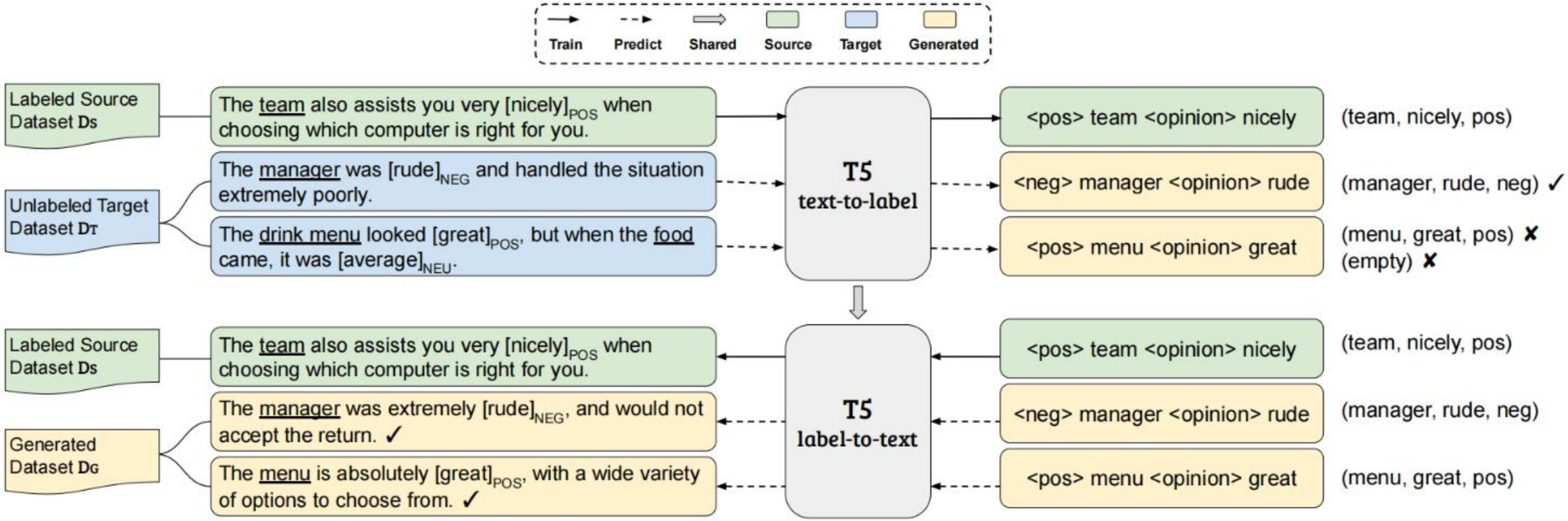
Introduction

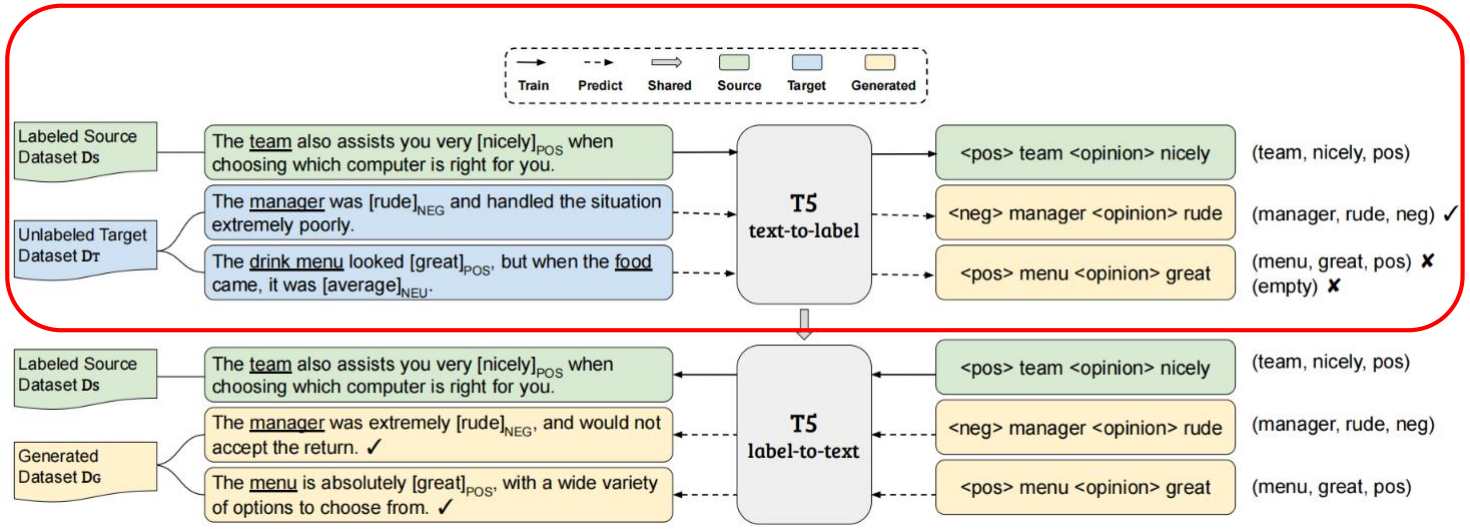
1 电子产品领域：这个屏幕不错，很清晰。
2 餐饮领域：他们的服务不错，很周到。

Aspect: ——
Opinion: ——

Overview

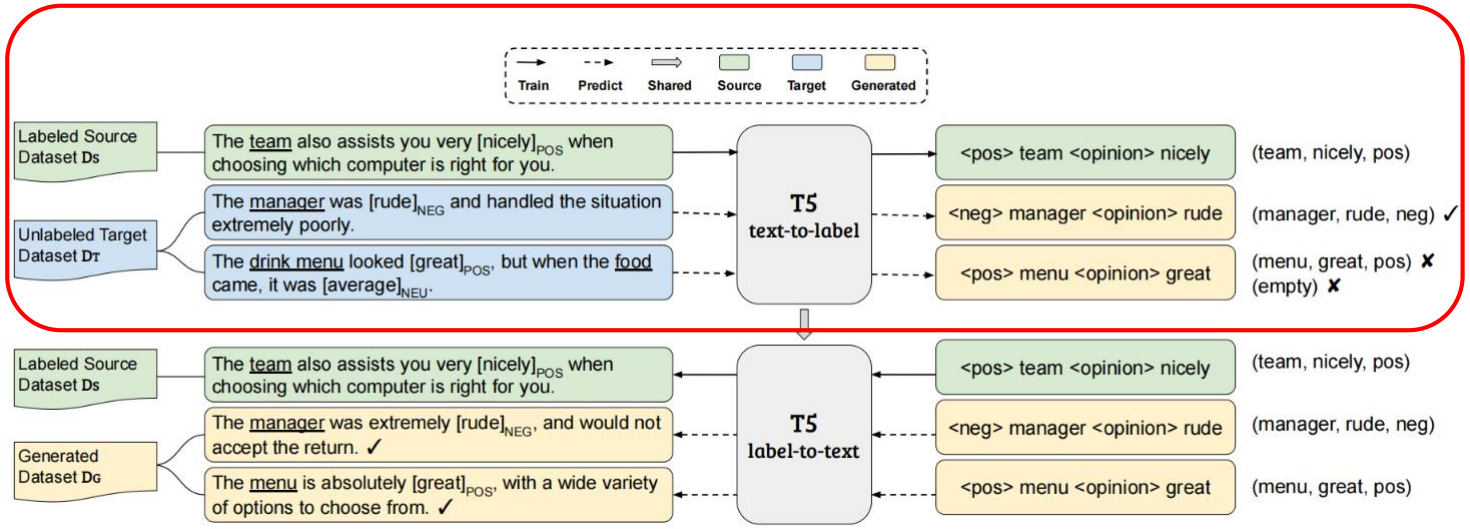

Train
Predict
Shared
Source
Target
Generated
Labeled Source Dataset Ds
Unlabeled Target Dataset DT
The team also assists you very [nicely]POS when choosing which computer is right for you.
The manager was [rude]NEG and handled the situation extremely poorly.
The drink menu looked [great]POS, but when the food came, it was [average]NEU.
T5 text-to-label
<pos> team <opinion> nicely
<neg> manager <opinion> rude
<pos> menu <opinion> great
(team, nicely, pos)
(manager, rude, neg) ✓
(menu, great, pos) ✘
(empty) ✘
Labeled Source Dataset Ds
Generated Dataset DG
The team also assists you very [nicely]POS when choosing which computer is right for you.
The manager was extremely [rude]NEG, and would not accept the return. ✓
The menu is absolutely [great]POS, with a wide variety of options to choose from. ✓
T5 label-to-text
<pos> team <opinion> nicely
<neg> manager <opinion> rude
<pos> menu <opinion> great
(team, nicely, pos)
(manager, rude, neg)
(menu, great, pos)

Method



$$
\begin{aligned}
\text{ATE}: &\quad \mathbf{x} \Rightarrow \langle aspect \rangle\, a \\
\text{UABSA}: &\quad \mathbf{x} \Rightarrow \langle pos \rangle\, a \\
\text{AOPE}: &\quad \mathbf{x} \Rightarrow \langle aspect \rangle\, a\, \langle opinion \rangle\, o \\
\text{ASTE}: &\quad \mathbf{x} \Rightarrow \langle pos \rangle\, a\, \langle opinion \rangle\, o
\end{aligned} \tag{1}
$$

Method

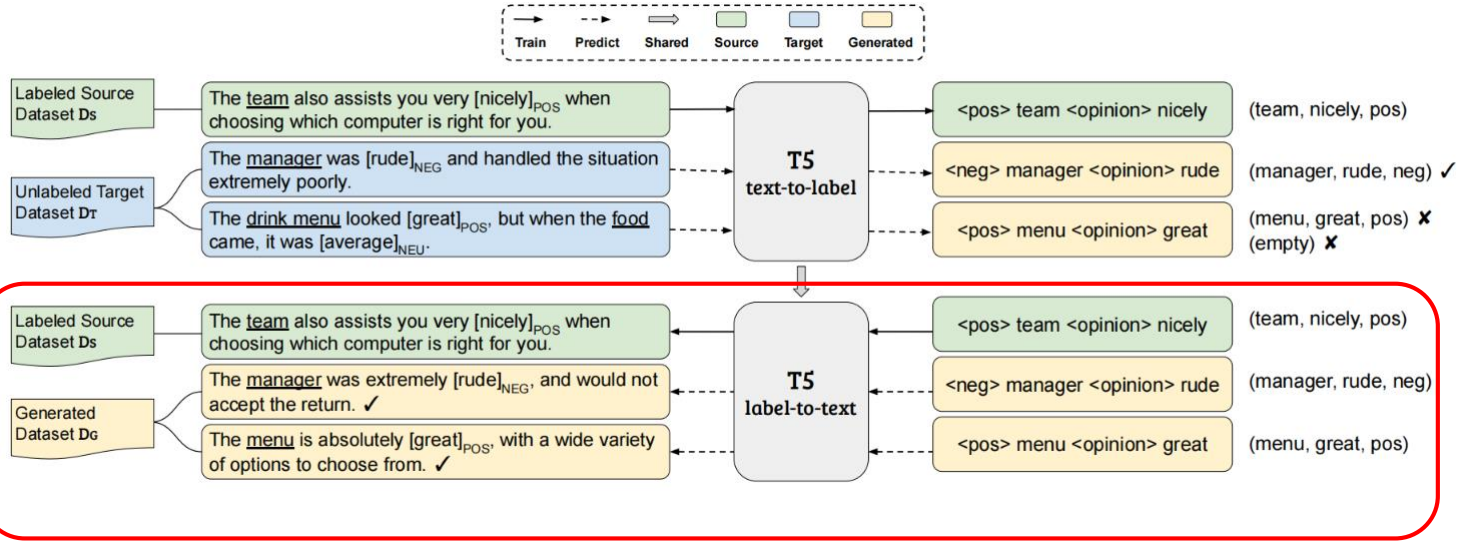


$$\mathcal{L} = -\sum_{i=-1}^{l} \log p\left(y_i \mid \mathbf{x}; y_{\leq i-1}\right), \qquad (2)$$

$$\hat{y}_i^{\mathcal{T}} = \underset{y_j \in \mathcal{U}}{\operatorname{argmax}}\, p\left(y_j \mid \mathbf{x}^{\mathcal{T}}; \hat{y}_{\leq i-1}^{\mathcal{T}}\right), \qquad (3)$$

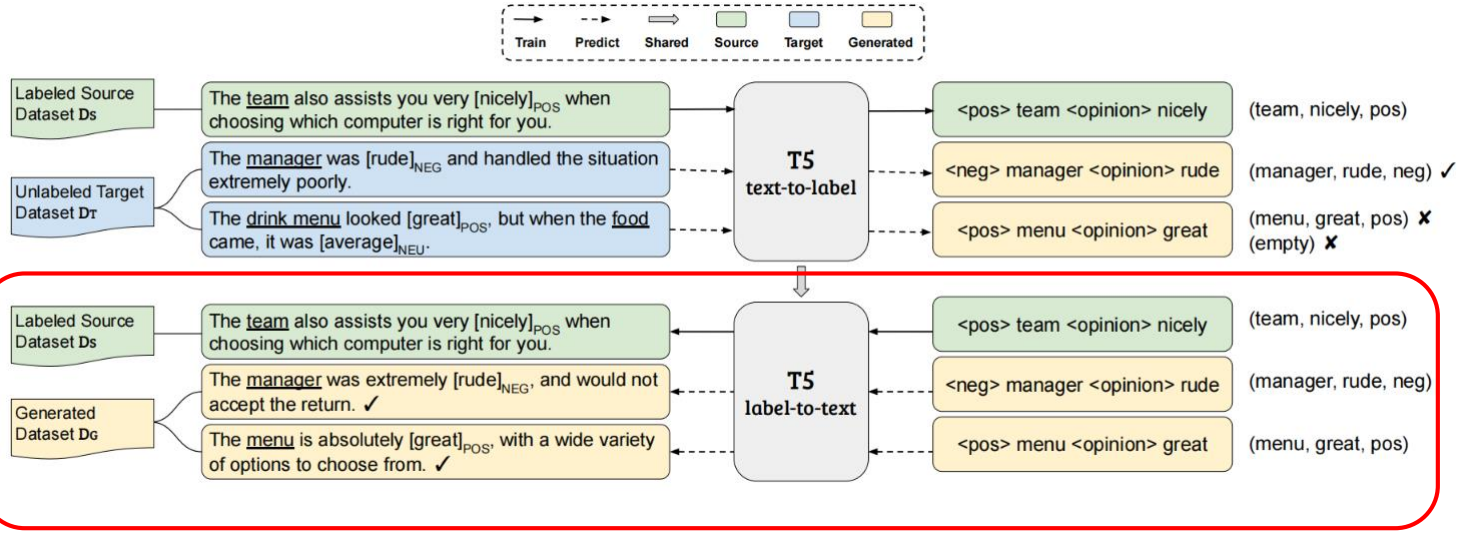
$$\mathcal{U} = \{w_i\}_{i=1}^{n} \cup \{\langle m_j \rangle\}_{j=1}^{k}.$$

Method



$$
\begin{aligned}
\text{ATE}: &\quad \langle aspect \rangle\, a \Rightarrow \mathbf{x} \\
\text{UABSA}: &\quad \langle pos \rangle\, a \Rightarrow \mathbf{x} \\
\text{AOPE}: &\quad \langle aspect \rangle\, a\, \langle opinion \rangle\, o \Rightarrow \mathbf{x} \\
\text{ASTE}: &\quad \langle pos \rangle\, a\, \langle opinion \rangle\, o \Rightarrow \mathbf{x}
\end{aligned} \tag{4}
$$

Method



$$\mathcal{L} = -\sum_{i=-1}^{l'} \log p\left(x_i \mid \mathbf{y}; x_{\leq i-1}\right), \qquad (5)$$

$$\hat{x}_i^{\mathcal{T}} = \underset{x_j \in \mathcal{V}}{\operatorname{argmax}}\, p\left(x_j \mid \hat{\mathbf{y}}^{\mathcal{T}}; \hat{x}_{\leq i-1}^{\mathcal{T}}\right), \qquad (6)$$

$\mathcal{V}$ denotes the vocabulary of the model.

Experiments

Task	Output Tuple	Example Output
ATE	(a)	(apple)
UABSA	(a, s)	(apple, positive)
AOPE	(a, o)	(apple, sweet)
ASTE	(a, o, s)	(apple, sweet, positive)

Experiments

Task	ATE&UABSA				AOPE				ASTE			
	L	R	D	S	L14	R14	R15	R16	L14	R14	R15	R16
Train	3045	3877	2557	1492	1035	1462	678	971	906	1266	605	857
Dev	304	387	255	149	116	163	76	108	219	310	148	210
Test	800	2158	1279	747	343	500	325	328	328	492	322	326

Table 2: The statistics of ATE and UABSA

Experiments

Methods	S→R	L→R	D→R	R→S	L→S	D→S	R→L	S→L	R→D	S→D	**Avg.**
ATE											
Hier-Joint†	46.39	48.61	42.96	27.18	25.22	29.28	34.11	33.02	34.81	35.00	35.66
RNSCN†	48.89	52.19	50.39	30.41	31.21	35.50	47.23	34.03	**46.16**	32.41	40.84
AD-SAL†	52.05	56.12	51.55	39.02	38.26	36.11	45.01	35.99	43.76	**41.21**	43.91
$BERT_B$-UDA†	56.08	51.91	50.54	34.62	32.49	34.52	46.87	43.98	40.34	38.36	42.97
$BERT_B$-CDRG†	56.26	60.03	52.71	42.36	47.08	41.85	46.65	39.51	32.60	36.97	45.60
GAS	61.24	53.02	56.44	31.19	32.14	35.72	52.24	43.76	42.24	37.77	44.58
$BERT_E$-UDA†*	59.07	55.24	56.40	34.21	30.68	38.25	54.00	44.25	42.40	40.83	45.53
$BERT_E$-CDRG†*	59.17	68.62	58.85	**47.61**	**54.29**	42.20	55.56	41.77	35.43	36.53	50.00
$BGCA_{text\text{-}to\text{-}label}$	60.03	55.39	55.83	36.02	35.43	37.73	54.18	43.45	42.49	37.89	45.84
$BGCA_{label\text{-}to\text{-}text}$	**63.20**	**69.53**	**65.33**	45.86	44.85	**54.07**	**57.13**	**46.15**	37.15	38.24	**52.15**
UABSA											
Hier-Joint†	31.10	33.54	32.87	15.56	13.90	19.04	20.72	22.65	24.53	23.24	23.72
RNSCN†	33.21	35.65	34.60	20.04	16.59	20.03	26.63	18.87	33.26	22.00	26.09
AD-SAL†	41.03	43.04	41.01	28.01	27.20	26.62	34.13	27.04	35.44	33.56	33.71
AHF	46.55	43.49	44.57	33.23	33.05	34.96	34.89	29.01	37.33	**39.61**	37.67
$BERT_B$-UDA†	47.09	45.46	42.68	33.12	27.89	28.03	33.68	34.77	34.93	32.10	35.98
$BERT_B$-CDRG†	47.92	49.79	47.64	35.14	38.14	37.22	38.68	33.69	27.46	34.08	38.98
GAS	54.61	49.06	53.40	30.99	29.64	33.34	43.50	35.12	39.29	35.81	40.48
$BERT_E$-UDA†*	53.97	49.52	51.84	30.67	27.78	34.41	43.95	35.76	40.35	38.05	40.63
$BERT_E$-CDRG†*	53.09	57.96	54.39	40.85	**42.96**	38.83	**45.66**	35.06	31.62	34.22	43.46
$BGCA_{text\text{-}to\text{-}label}$	54.12	48.08	52.65	33.26	30.67	35.26	44.57	36.01	**41.19**	36.55	41.24
$BGCA_{label\text{-}to\text{-}text}$	**56.39**	**61.69**	**59.12**	**43.20**	39.76	**47.94**	45.52	**36.40**	34.16	36.57	**46.07**

Experiments

Methods	R14→L14	R15→L14	R16→L14	L14→R14	L14→R15	L14→R16	Avg.
AOPE							
SDRN	45.39	37.45	38.66	47.63	41.34	46.36	42.81
RoBMRC	52.36	46.44	43.61	54.70	48.68	55.97	50.29
SpanASTE	51.90	48.15	47.30	61.97	55.58	63.26	54.69
GAS	57.58	53.23	52.17	64.60	60.26	66.69	59.09
BGCA$_{\text{text-to-label}}$	58.54	54.06	51.99	64.61	58.74	67.19	59.19
BGCA$_{\text{label-to-text}}$	**60.82**	**55.22**	**54.48**	**68.04**	**65.31**	**70.34**	**62.37**
ASTE							
RoBMRC	43.90	40.19	37.81	57.13	45.62	52.05	46.12
SpanASTE	45.83	42.50	40.57	57.24	49.02	55.77	48.49
GAS	49.57	43.78	45.24	64.40	56.26	63.14	53.73
BGCA$_{\text{text-to-label}}$	52.55	**45.85**	46.86	61.52	55.43	61.15	53.89
BGCA$_{\text{label-to-text}}$	**53.64**	45.69	**47.28**	**65.27**	**58.95**	**64.00**	**55.80**

Experiments

Methods	ATE	UABSA	AOPE	ASTE	Avg.
BGCA†	**52.15**	**46.07**	**62.37**	55.80	**54.10**
- self-training*	46.13	41.56	61.33	**55.99**	51.25
- continue*	46.63	42.22	58.56	54.70	50.53
- w/o sharing	52.08	44.72	61.64	55.76	53.55

Experiments

Sentence from R	Prediction	Label-to-text Generation
The [service]$_{\text{POS}}$ was good to excellent along with the [attitude]$_{\text{POS}}$.	(service, POS)	The [service]$_{\text{POS}}$ I received from Toshiba was excellent.
[Bottles of wine]$_{\text{POS}}$ are cheap and good.	(bottles, POS)	I love the [bottles]$_{\text{POS}}$ they are made out of.
Our [waitress]$_{\text{NEU}}$ wasn't mean, but not especially warm or attentive either.	(waitress, NEG)	The [waitress]$_{\text{NEG}}$ didn't even answer my question.

Experiments

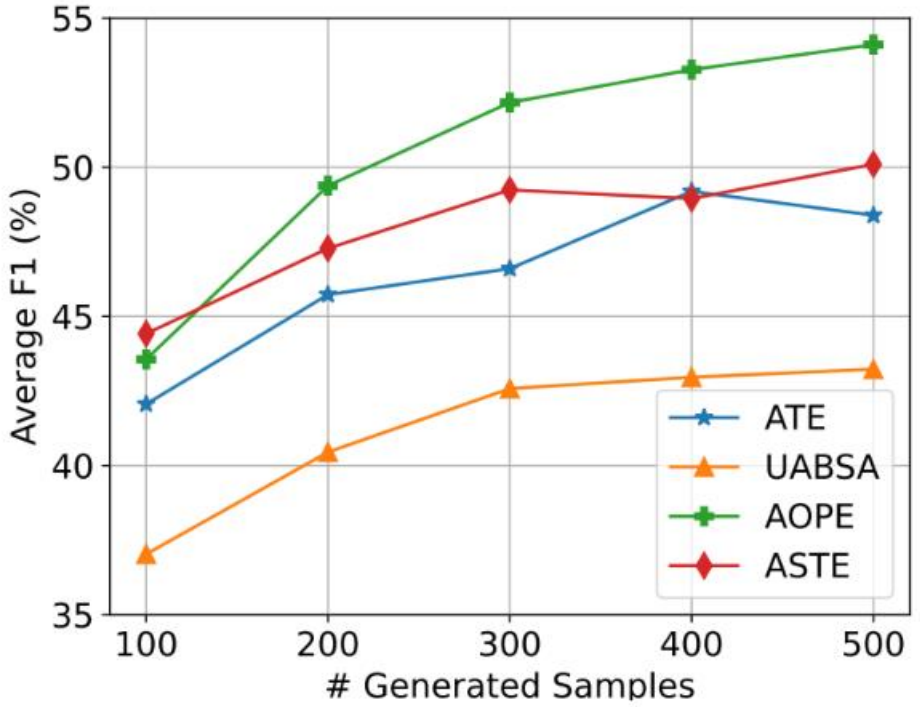


Figure 2: Comparison results of our method with a different number of generations.

Experiments

Group	ATE		UABSA	
	text→label	label→text	text→label	label→text
Zero	45.31	36.48	50.02	39.18
Single	41.53	47.99	35.02	43.17
Multiple	26.61	37.20	21.99	29.59

Table 7: Comparison results on cross-domain ATE and UABSA tasks over different sentence groups containing zero, single, or multiple aspects respectively.

Thanks!