Fortunately, Discourse Markers Can Enhance Language Models for Sentiment Analysis

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Part 1,

Introduction

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Introduction

Fortunately, Discourse Markers Can Enhance Language Models for Sentiment Analysis

- **Pre trained language models 은 large data에 대해 trained 되고 downstream task 에 대해 작은 labeled data로 fine tuning**
- **최근 모델은 annotation effort를 거의 들이지 않아도 넓은 범위의 target task에서 좋은 성능을 나타냄'**
- **이 2단계 step을 더 정교하게 설계하면, 특정 interest 에 대한 particular task에서 좋은 starting point model이 됨**
  - Domain specific data such as financial or legal documents is beneficial to tasks
  - Additional pretraining of BERT on dialogue data yields better results
  - Product review data에 대해 Sentiment aware pretraining을 더하면 sentiment analysis 성능 향상
  - SpanBERT, PEGASUS

    → Question answering, summarization 목적에 맞게 여러 단어를 masking해 pretraining

    → span-extraction: 주어진 context 및 관련 question을 이해하여, 지문과 관련된 질문에 적절한 답변을 지문 속에서 도출

Part 1,

Introduction

Fortunately, Discourse Markers Can Enhance Language Models for Sentiment Analysis

- 본 논문에서는 intermediate training step(inter-training)을 추가
  - Aligned with a specific target task of interest

- Inter-training approach (similarity between the intermediate task and the target task)
  1. Weakly labeled data를 사용하고 완전 같음
  2. 살짝 다른 task에 labeled data를 사용해 transfer learning
  3. No labeled data를 사용한 transfer learning

Part 1,

Introduction

Fortunately, Discourse Markers Can Enhance Language Models for Sentiment Analysis

- Leverage the signal carried by DM to generate large amounts of weakly labeled data for sentiment analysis
- “Happily”, “Sadly” convey a positive/negative sentiment
- Inter-training BERT on this data → significant performance
  - Especially on scarce labeled data, zero-shot scenario

Part 2,

Related Works

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- Learning with Discourse Markers
  - Discourse marker: Managing the flow and structure of discourse

    Learning signal for the prediction of implicit discourse relations

- Sileo et al.(2020)
  - 처음으로 DM과 downstream task class의 연관관계를 분석
  - Semantic relation이 정해진 두 sentence pair 사이 plausible DM을 예측

Part 2,

Related Works

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- **Task-aware Language Models**
  - For sentiment analysis,
  - Sentiment knowledge를 pretraining task에 포함시키려는 연구 다수
  - 주로 word-level sentiment prediction task에 focus

- **This paper suggests a model that incorporates a sentence level sentiment prediction objective**

Part 3,

Model

Part 3,

SenDM

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- **SenDM: A New Sentiment Language Model Training DM-based Sentiment Models**
  - C: general corpus of news paper and journal articles
  - L:3 annotators, a list of 173 commonly used DMs
  - Lg: consists of 11 DMs, selected by 3 annotators

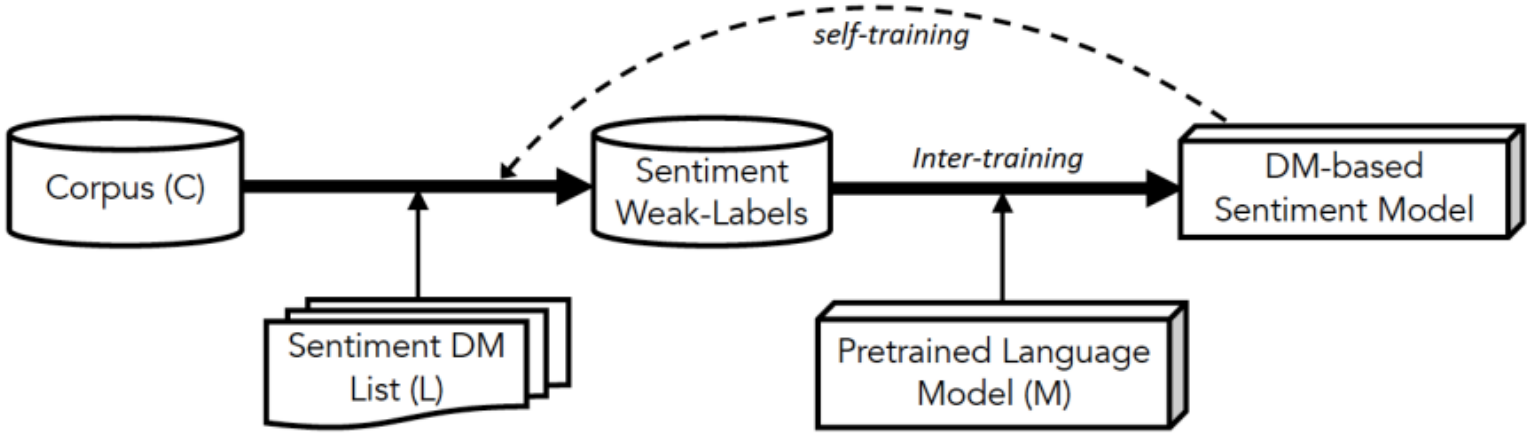

Figure 1: Overview of how DM-based sentiment models are trained.

SenDM

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- **Inter-training Details**
  - **Weakly-labeled data를 사용해 BERT를 fine tuning하는 작업 포함**
  - **Obtain a total of 1,876,614 weakly labeled sentences**

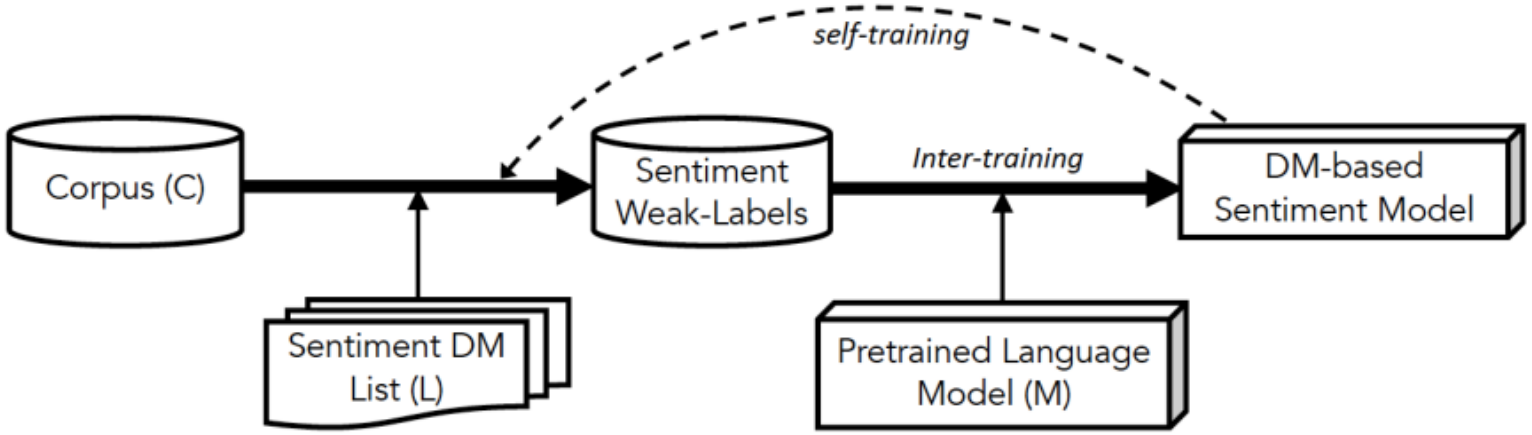

Figure 1: Overview of how DM-based sentiment models are trained.

Part 4,

Experiments

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- Dataset

Dataset	Domain	Test set size
amazon	Product reviews	2K
yelp	Business reviews	20K
sst2	Movie reviews	1821
fpb75	Financial news	691

- 3 scenarios
  - Zero-shot: simply use the classification layer obtained from inter-training
  - Few-shot: fine-tune inter-trained model with a small sample of n
  - Full-data: all training examples are used

Part 5,

Results

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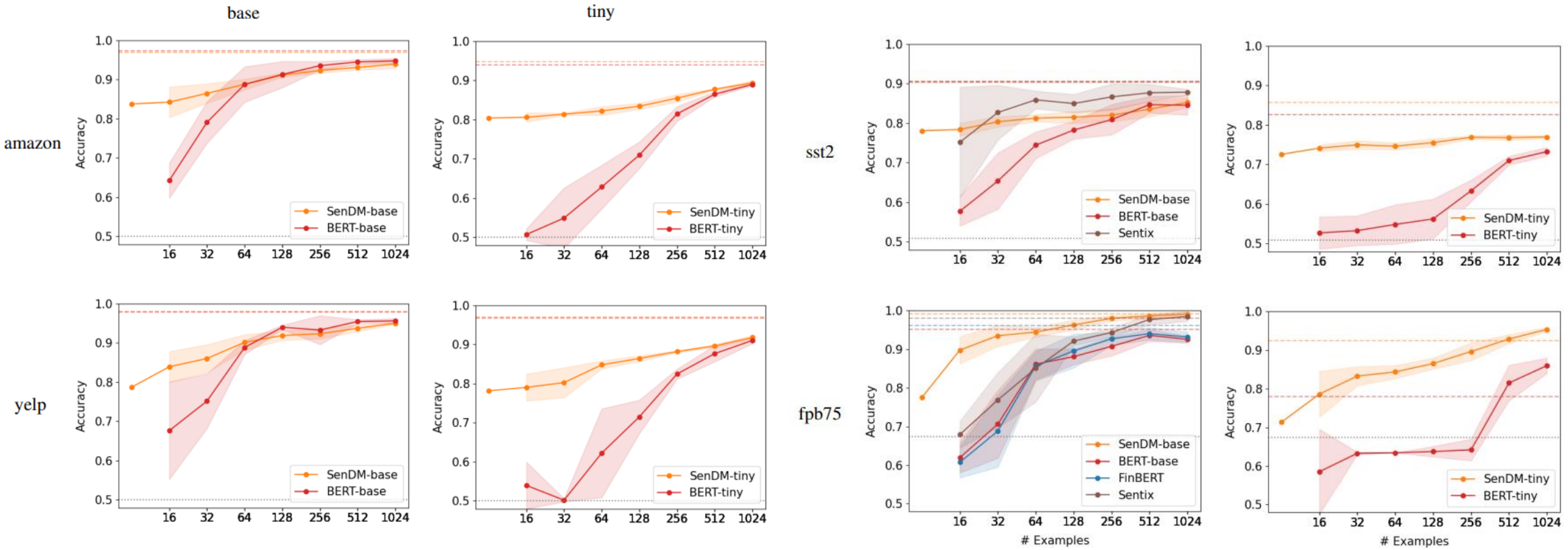

Part6 ,

Adapting SenDM to a New Domain

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- Adapting SenDM to a new domain, finance domain
  - Financial sentiment analysis is a challenging task
  - Import ant task for potential users

- Training Approach
  - Cd: domain specific text corpus
  - Ld: domain specific DM list

Part 6,

Adapting SenDM to a New Domain

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- Training Approach
  - Cd: domain specific text corpus
  - Ld: domain specific DM list

Model name	C	L	M	With self-training
$SenDM$	C_g	L_g	BERT	NA
$SenDM_d^{L_g}$	C_d	L_g	$SenDM$	No
$SemDM_d^{L_d}$	C_d	L_d	$SenDM$	No
$SenDM_d^{P}$	C_d	NA	$SenDM$	Yes
$SenDM_d^{L_g+P}$	C_d	L_g	$SenDM$	Yes
$SemDM_d^{L_d+P}$	C_d	L_d	$SenDM$	Yes

Part 6,

Adapting SenDM to a New Domain

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- Domain specific sentiment related DMs
  - 1. Identifying a list of candidate DMs
    - Grouping using NER (e.g., instead of multiple bigrams of the type ”on Sept 9th”, ”on 10/2/2020”,... we generate one bigram ”on DATE”)
  - 2. Using SenDM to select the domain specific DMs out of the candidate list
    - Analyse the sentences to start with the DMs in the candidate list
    - Sample sentences to start with the DM
    - SenDM에 의해 높은 신뢰도로 scored 된 sentence의 경우 감정을 부여

Part 6,

Adapting SenDM to a New Domain

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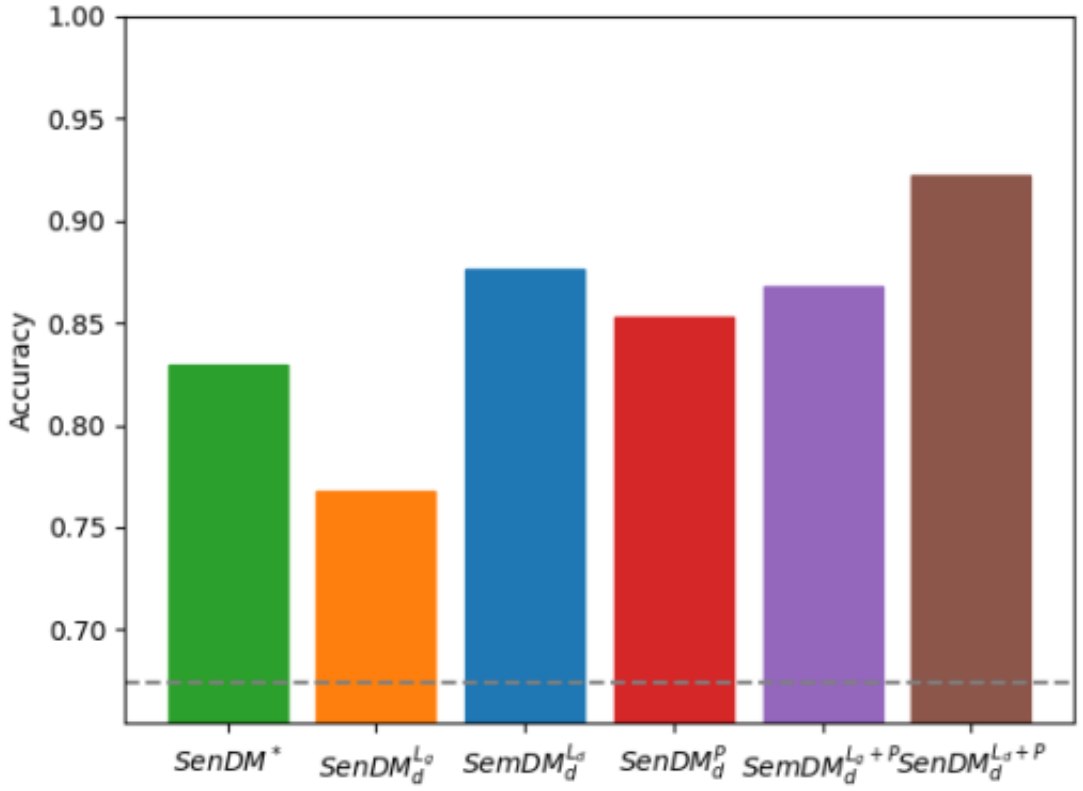
- **Results**



Part 6,

Adapting SenDM to a New Domain

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- **Domain specific DMs**

Domain	Associated with Positive Sentiment	Associated with Negative Sentiment
General	'fortunately', 'happily', 'hopefully', 'ideally', 'luckily', 'thankfully'	'admittedly', 'curiously', 'inevitably', 'sadly', 'unfortunately'
Finance	'as ORG', 'at the event', 'fortunately', 'hopefully', 'ideally', 'in future', 'in other business', 'luckily', 'once completed','ORG CEO', 'starting DATE', 'thankfully', 'the program', 'this way', 'to achieve this', 'under his leadership', 'with ORG'	according to police', 'sadly', 'the problem', 'the problem is', 'unfortunately', 'worse'
Sports	'beginning DATE', 'fortunately', 'in the future', 'luckily', 'thankfully', 'that way'	'admittedly', 'alas', 'granted', 'ironically', 'sadly', 'true', 'unfortunately', 'unfortunately for ORG'
Science	'established in DATE', 'if necessary', 'if possible', 'if successful', 'luckily', 'that way', 'to address this', 'when possible', 'whenever possible', 'where possible', 'with this approach'	'admittedly', 'at ORDINAL glance', 'at times', 'curiously', 'even then', 'even worse', 'in part', 'inevitably', 'paradoxically', 'predictably', 'regrettably', 'the problem', 'there was', 'too often', 'unsurprisingly', 'without it', 'women'

Part 6,

Conclusion

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- **Contribution**

  1. A novel approach that leverages sentiment signals of discourse markers for creating sentiment-aware language models that significantly outperform prior models.

  2. A new method for enhancing domain-specific sentiment classification, based on statistical analysis of discourse markers in a domain-specific corpus.

  3. A large dataset of weakly labeled sentences from Wikipedia, and a code for generating weakly labeled data from a given text corpus

Part 6,

Conclusion

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- **Conclusion**
  - **This approach can be easily adapted to other languages**
  - **Leveraging DM to create task-specific language models can be potentially applied to other tasks**
  - **This approach shows how to enhance zero-shot learning performance**