

A Experimental Details

Hyperparameters Tuning We have empirically found that simply using a linear layer as our mapping f fails to fit the training set well. In addition, for the model that utilizes contextualized embeddings extracted from BERT, replacing the conv1d and max-pooling with the simple average of all embeddings of the corresponding word pieces leads to worse results. The maximum number of word pieces is clipped to 3 considering not only statistics but also computational cost. In the one-dimensional convolution, we have tried different kernel sizes and eventually chose to use 256 filters with the kernel size equal to 3 in order to tackle all input word pieces, and the other 256 ones with the kernel size equal to 1 are incorporated with max-pooling, only considering the most activated word piece.

With adam as our optimizer, we let the learning rate be reduced by half if the loss on the validation set has stopped improving within 5 epochs. All hyperparameters are tuned on the hold-out validation set.

Fine-Tuning Contextualized Embeddings In order to further investigate the definition mapping task, we also conduct the experiments that allow the pretrained BERT model to be fine-tuned jointly when training our mapping. It is found that the results are much worse than the results of leveraging the frozen BERT representations shown in Table 1 no matter which architecture is used in our mapping. The relative worse performance on the training set may indicate that BERT suffers from catastrophic forgetting during fine-tuning in our task, despite our training set is large. We posit that it is because our task is much harder than others in the GLUE benchmark, where the model is required to disambiguate from near 80,000 definitions. More investigation is needed to address this issue.

Details in Pretrained Representations Both context embeddings and the definition embeddings are encoded by the Transformer-based universal sentence encoder⁴, with the dimension in \mathbb{R}^{512} . The dimension of representations from BERT-base⁵ $\in \mathbb{R}^{768}$, while the ones from BERT-

large and ELMo⁶ $\in \mathbb{R}^{1024}$. The context-independent embeddings of all proposed variants are initialized with pretrained fasttext embeddings⁷ in \mathbb{R}^{300} .

Evaluation Metrics The BLEU score has many variants. In our experiments, we apply the commonly-used corpus-level BLEU@4 without smoothing from the NLTK package. We also measure the ROUGE-L:F score, the longest common subsequence based statistics, with the python ROUGE package⁸.

B Generated Synonyms

The examples of generated synonyms retrieved by reversing the mapping as referred in Section 2.3 are shown in Table 5. In more detail, we freeze the pretrained mapping and the context-dependent component, i.e., the contextualized representations from BERT, ELMo or the context embedding from the universal sentence encoder, and then probe through all target word embeddings in the training set to obtain the word that could maximize the cosine similarity between the predicted definition embedding and the ground truth one.

C Sample Outputs

The randomly-sampled examples from the output of the proposed model with contextualized embeddings from BERT-base on the **Seen** task are shown in Table 6, and the ones on the **Unseen** task are in Table 7.

⁴<https://tfhub.dev/google/universal-sentence-encoder-large/3>

⁵<https://pytorch-pretrained-bert/>

⁶<https://pypi.org/project/allennlp/0.8.4/>

⁷<https://fasttext.cc/docs/en/english-vectors.html>

⁸<https://pypi.org/project/rouge/0.3.1/>

Contexts, Generated Synonyms, Ground Truth
Context: Dressed <i>all</i> in black. Generated Synonyms: all, altogether, strictly, totes, ferociously, bang exceedingly, completely, wholly, terribly, definitely, easily Ground Truth: <i>all</i> , totally, outright, altogether, completely, absolutely, quite, wholly, fully, thoroughly, utterly, entirely
Context: Worse <i>yet</i> concert goers with floor tickets had to remain outside in front of gate. Generated Synonyms: yet, entirely, anyone, anywhere, still, ever Ground Truth: <i>yet</i> , besides, even, additionally, further, still
Context: If you have green eyes, <i>brighten</i> your eyes with a plum hue. Generated Synonyms: brighten, flamboyant, embellish, lurid Ground Truth: <i>brighten</i> , enhance, embellish, enrich
Context: As the disease progresses the cone becomes more pronounced causing vision to become blurred and <i>distorted</i> . Generated Synonyms: distorted, crooked, compressed, strained, stiffen slippage, sore, tuber, convoluted, recurrent Ground Truth: <i>distorted</i> , crooked, twisted, awry, misshapen, deformed, bent, wry, malformed, irregular
Context: The hospital trust shares its medical <i>expertise</i> in the field of blood diseases with the facility in India. Generated Synonyms: expertise, prowess, knowhow, ustad, literacy Ground Truth: <i>expertise</i> , skill, prowess, competence, proficiency

Table 5: Samples of generated synonyms obtained by reversing the trained mapping.

Target Word	Contexts, Selected Definitions, Ground Truth
living	The aim of the scheme is to improve the city environment and make better use of <i>living</i> space. 1st Definition: of a place used for living rather than working in 2nd Definition: a place regarded as giving access to another place 3rd Definition: denoting or relating to accommodation designed for occupation by more than one family Ground Truth: of a place used for living rather than working in
	A <i>living</i> language both accumulates new words of value and preserves what is old and of value. 1st Definition: of a language still spoken and used 2nd Definition: of a language tending to have each element as an independent word without inflections 3rd Definition: of a form of a language as used in former or earliest times Ground Truth: of a language still spoken and used
	But as I said I'm aware of the problems earning enough money to make a <i>living</i> . 1st Definition: an income sufficient to live on or the means of earning it 2nd Definition: give or bequeath an income or property to a person or institution 3rd Definition: of income or resources making it unnecessary to earn ones living Ground Truth: an income sufficient to live on or the means of earning it
push	He patted me on the back and gave me a slight <i>push</i> to the door as if I should do it right now. 1st Definition: an act of pushing someone or something in order to move them away from oneself 2nd Definition: an act of moving on ones hands and knees or dragging ones body along the ground 3rd Definition: an act of pushing or shoving something Ground Truth: an act of pushing someone or something in order to move them away from oneself
	The electric beds which can be raised and lowered at the <i>push</i> of a button will help give patients 1st Definition: an act of pressing a part of a machine or device 2nd Definition: a device which prevents or stops a specified thing 3rd Definition: a device used to prevent the operation or movement of a vehicle or other machine Ground Truth: an act of pressing a part of a machine or device
	American Forces then embarked on the long push to Tokyo. 1st Definition: a military attack in force 2nd Definition: the action of returning a military attack counterattack 3rd Definition: a disorderly retreat of defeated troops Ground Truth: a military attack in force
view	... I only have to lift my eyes by ten degrees and I have a sumptuous panoramic <i>view</i> of a building site. 1st Definition: a sight or prospect typically of attractive natural scenery ... by the eye from a particular place 2nd Definition: the ability to see something or to be seen from a particular place 3rd Definition: an object or feature of a landscape or town that is easily seen and recognized from a distance ... Ground Truth: a sight or prospect typically of attractive natural scenery ... by the eye from a particular place
	Matisse's <i>view</i> of Collioure. 1st Definition: the distinctive nature or qualities of something 2nd Definition: an attribute quality or characteristic of something 3rd Definition: a tangible or visible form of an idea quality or feeling Ground Truth: a work of art depicting a sight of natural scenery
	Members of the public can <i>view</i> these and other documents at the national archive. 1st Definition: inspect a house or other property with the intention of possibly buying or renting it 2nd Definition: show or provide something for consideration inspection or use 3rd Definition: examine and report on the condition of a building especially for a prospective buyer Ground Truth: look at or inspect

Table 6: Randomly sampled examples of the top 3 selected definitions on the **Seen** task.

Target Word	Contexts, Selected Definitions, Ground Truth
construction	<p>There is, so far as I am aware, no authority on the true <i>construction</i> of this clause. 1st Definition: a general statement or concept obtained by inference from specific cases 2nd Definition: the precise terms of a statement or requirement the strict verbal interpretation 3rd Definition: the action of making a statement or situation less confused and more comprehensible Ground Truth: an interpretation or explanation</p>
	<p>... intellectual predilection for stressing the active role of individuals in the social <i>construction</i> of social reality. 1st Definition: the action of creating or preparing something 2nd Definition: the process of analysing and developing an idea or principle in detail 3rd Definition: the process of deciding or planning something Ground Truth: the creation of an abstract entity</p>
	<p>That tells us that the <i>construction</i> is an interrogative complement clause in each case. 1st Definition: the arrangement of words and phrases to create wellformed sentences in a language 2nd Definition: in systemic grammar a level of structure between clause and word ... 3rd Definition: a single distinct meaningful element of speech or writing used with others ... Ground Truth: the arrangement of words according to syntactical rules</p>
inflate	<p>Unfortunately, the balloon refused to <i>inflate</i> properly and just dragged along on the surface of the sea. 1st Definition: extend outwards beyond something else protrude 2nd Definition: extending upwards over 3rd Definition: become or make less wide Ground Truth: become distended with air or gas</p>
	<p>If there is one thing the Fed can do, they say, it is <i>inflate</i> the currency. 1st Definition: make a slight reduction in the amount rate or price of 2nd Definition: bring about a general reduction of price levels in an economy 3rd Definition: exclude a nonnet amount such as tax when making a calculation in order to reduce the amount ... Ground Truth: bring about inflation of a currency or in an economy</p>
	<p>On his bicycle fitted with a luggage box ... a vacuum pump to <i>inflate</i> the cycle tyres whenever necessary. 1st Definition: become or make less wide 2nd Definition: squeeze or force into a small or restricted space 3rd Definition: extend across or through Ground Truth: fill a balloon tyre or other expandable structure with air or gas so that it becomes distended</p>

Table 7: More randomly sampled examples of the top3 selected definitions on the **Unseen** task.