



# Exploiting Sentiment and Common Sense for Zero-shot Stance Detection

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(COLING-2022)

Code: <https://github.com/LuoXiaoHeics/StanceCS>.



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Reported by Zhaoze Gao



1. Introduction
2. Approach
3. Experiments



# Introduction

<b>Example 1 Topic :</b> Olympics	<b>Stance :</b> Pro
<b>Text :</b> The <b>games</b> should proceed. <b>Athletes</b> have made tremendous sacrifices to qualify and be prepared. It would be cruel to deny them their chance. In the future the Games should be held in countries within the top say 15 GDP per capita.	
<b>Example 2 Topic :</b> Nuclear power	<b>Stance :</b> Pro
<b>Text :</b> I totally <b>agree</b> with this premise. As a younger person I was against <b>Nuclear power</b> (I was in college during 3 mile island) but now it seems that nuclear should be in the mix. Fission technology is <b>better</b> , and will continue to get <b>better</b> if we <b>actively promote</b> its development. The <b>prospect</b> of fusion energy also needs to be explored. If it's <b>good</b> enough for the sun and the stars, it's <b>good</b> enough for me.	

the document does **not explicitly** contain the **topic** 'Olympics', but 'Games' and 'Athlete' implicitly refer to the topic.

the document contains **many positive words** like 'good', and 'better' regarding the topic 'nuclear power', which implies a **Pro stance**.

Figure 1: Examples for stance detection VAST.

# Approach

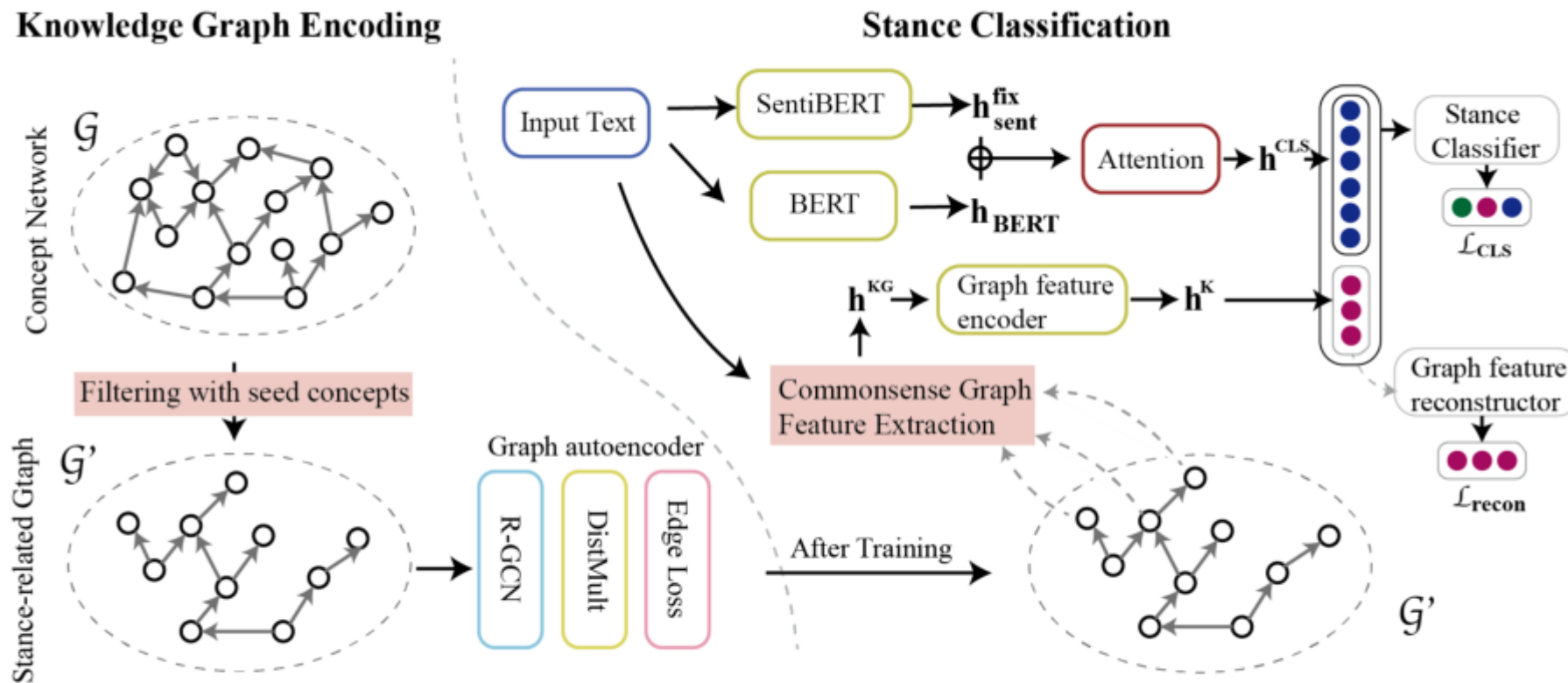


Figure 2: Framework of our proposed model, which contains two components, (1) knowledge graph encoding, (2) stance detection with sentiment and common sense.



# Approach

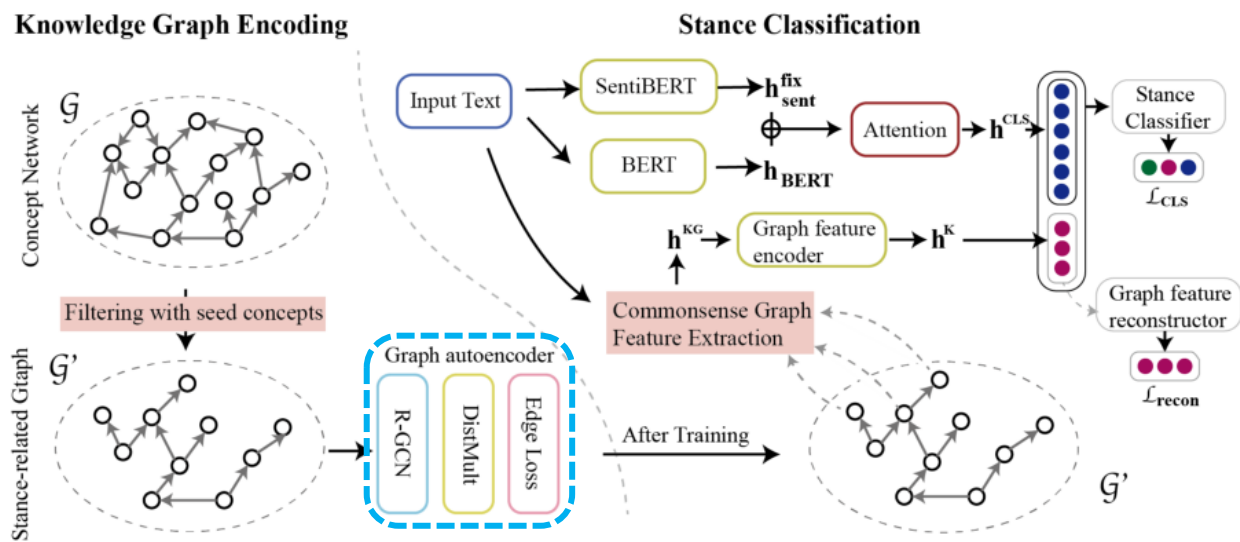


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$$f(x_i, l) = \sigma\left(\sum_{r \in \mathcal{R}} \sum_{j \in \mathcal{N}_i^r} \frac{1}{v_{i,r}} W_r^{(l)} x_j + W_0^{(l)} x_i\right),$$

$$\mathbf{h}_i = \mathbf{h}_i^{(2)} = f(\mathbf{h}_i^{(1)}, 2); \mathbf{h}_i^{(1)} = f(\mathbf{g}_i, 1), \quad (1)$$

$$s(v_i, r, v_j) = \sigma(\mathbf{h}_{v_i}^T R_r \mathbf{h}_{v_j}), \quad (2)$$

$$\mathcal{L}_{G'} = -\frac{1}{2|\hat{\mathcal{E}}'|} \sum_{(v_i, r, v_j, y) \in \mathcal{T}} (y \log s(v_i, r, v_j) + (1 - y) \log(1 - s(v_i, r, v_j))). \quad (3)$$

# Approach

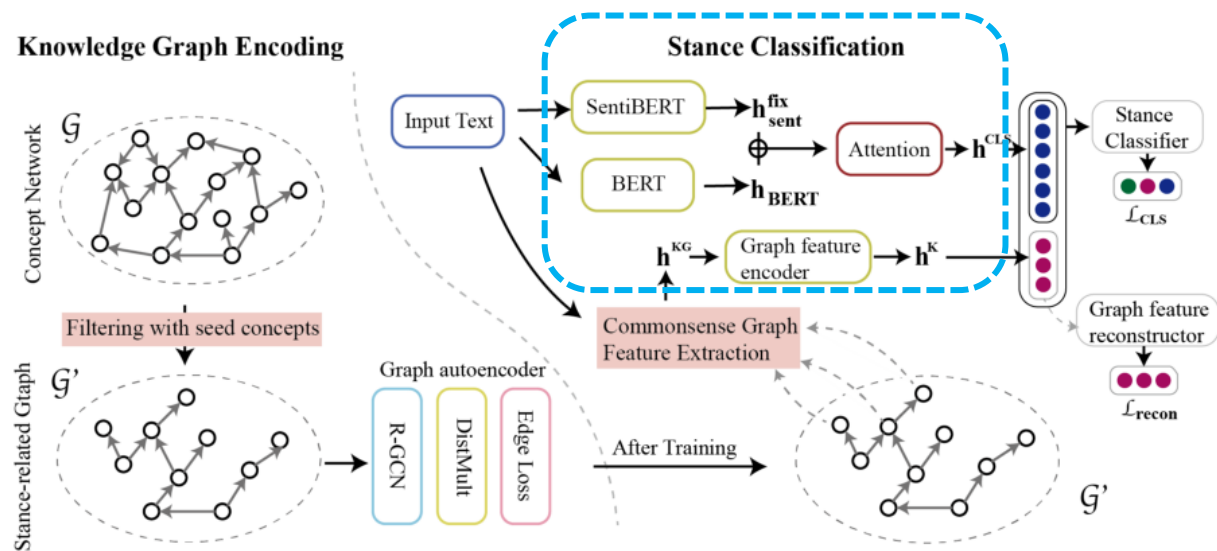


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$$x = [CLS] d [SEP] t [SEP]$$

$$\mathbf{h}_{sent}^{fix} = SentiBERT(x), \quad (4)$$

$$\mathbf{h}^K = W_k \mathbf{h}^{KG} + b_k \quad (5)$$

$$\mathbf{h}_{BERT} = BERT(x) \quad (6)$$

$$\mathbf{h}^{CLS} = CrossAttention([\mathbf{h}_{BERT}, \mathbf{h}_{sent}^{fix}])[CLS], \quad (7)$$

# Approach

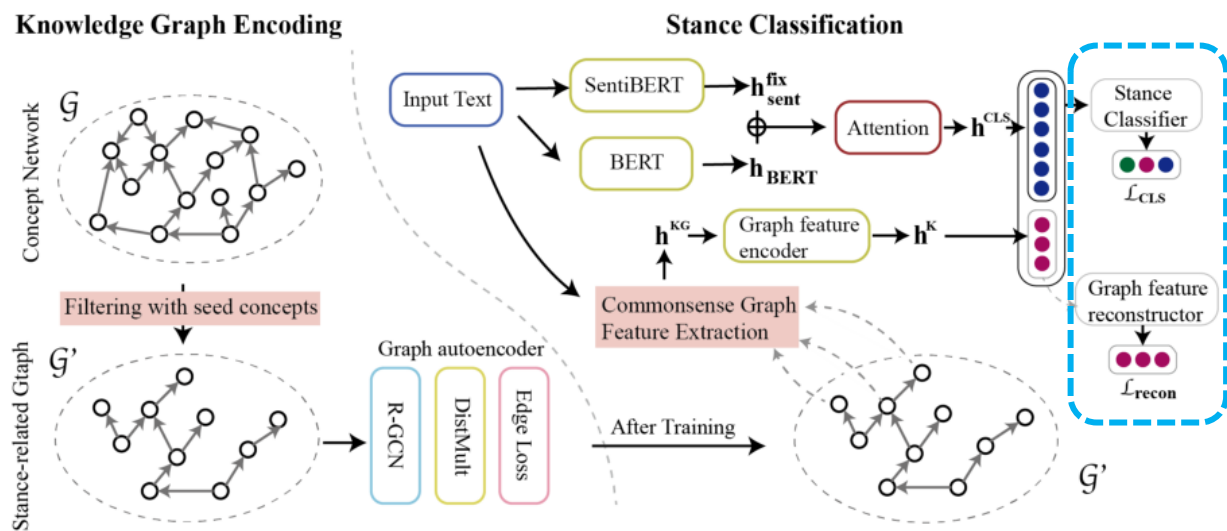


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$$p = \text{Softmax}(W[\mathbf{h}^{CLS}, \mathbf{h}^K] + b), \quad (8)$$

$$\mathcal{L}_{cls} = -\frac{1}{|N|} \sum_{(x_i, y_i)} y_i \log p(y_i), \quad (9)$$

$$\mathcal{L}_{recon} = -E_{\mathbf{h}^{KG}} (\|D_{recon}(\mathbf{h}^K) - \mathbf{h}^{KG}\|_2^2). \quad (10)$$

$$\mathcal{L} = \mathcal{L}_{cls} + \mathcal{L}_{recon}. \quad (11)$$



# Experiments

	#Exp	#Doc	#Zero-shot	#Few-shot
Train	13477	638	1481	4003
Dev	2062	114	682	383
Test	3066	159	786	600

Table 1: Statistics on the VAST dataset.



# Experiments

Model	macro F1 Zero-shot				macro F1 Few-Shot				macro F1 All			
	pro	con	neu	all	pro	con	neu	all	pro	con	neu	all
BiCond	.459	.475	.349	.427	.454	.463	.259	.392	.457	.468	.306	.410
Cross-Net	.462	.434	.404	.434	.508	.505	.410	.474	.486	.471	.408	.455
SEKT	.504	.442	.308	.418	.510	.479	.215	.474	.507	.462	.263	.411
BERT-sep	.414	.506	.454	.458	.524	.539	.544	.536	.473	.522	.501	.499
BERT-joint	.546	.584	.853	.660	.543	.597	.796	.646	.545	.591	.823	.653
TGA-Net	.554	.585	.858	.666	.589	.595	.805	.663	.573	.590	.831	.665
BERT-joint-ft	.579	.603	.875	.685	.595	.621	.831	.684	.588	.614	.853	.684
TGA-Net-ft	.568	.598	.885	.684	.628	.601	.834	.687	.599	.599	.859	.686
Prior-Bin:gold	<b>.643</b>	.581	.852	.692	.632	.563	<b>.881</b>	.692	<b>.652</b>	.597	.824	.691
BERT-GCN	.583	.606	.869	.686	.628	.634	.830	.697	.606	.620	.849	.692
CKE-Net	.612	.612	.880	.702	<b>.644</b>	.622	.835	.701	.629	.617	.857	.701
<i><b>Our Model</b></i>												
BS	.625	.667	.870	.717	.601	.667	.828	.699	.591	.669	.858	.706
S-RGCN	.582	.669	.838	.699	.561	.623	.809	.665	.607	.657	.842	.702
B-RGCN	.594	.657	.885	.712	.568	<b>.678</b>	.851	.699	.591	.663	.865	.706
BS-RGCN( <i>proposed</i> )	.608	<b>.674</b>	<b>.895</b>	<b>.726</b>	.600	.665	.839	<b>.702</b>	.604	<b>.669</b>	<b>.866</b>	<b>.713</b>

Table 2: Overall results. The suffix "ft" means BERT is fine-tuned. BS – the combination of BERT and SentiBERT; S-RGCN – the combination of SentiBERT and the graph autoencoder; B-RGCN – the combination of BERT and the graph autoencoder; BS-RGCN – our proposed model.



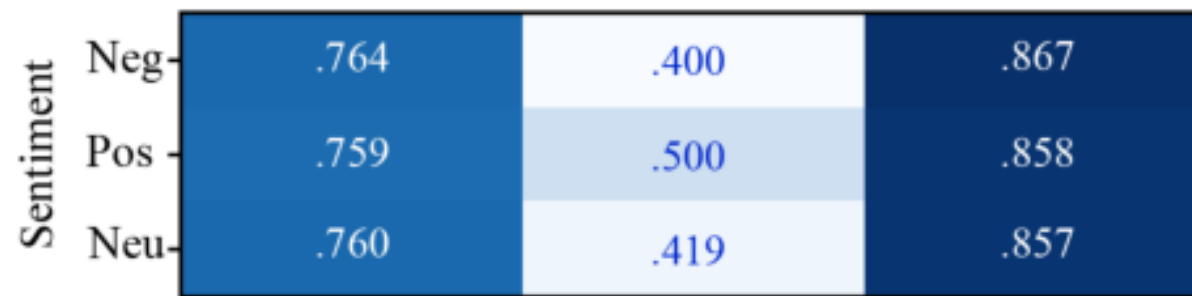
# Experiments

Model	Imp	mlT	mlS	Qte	Sarc
BERT-joint	.571	.590	.524	.634	.601
TGA-Net	.594	.605	.532	.661	.637
BERT-joint-ft	.617	.621	.547	.668	.673
BERT-GCN	.619	.627	.547	.668	.673
CKE-Net	<b>.625</b>	.634	.553	.695	.682
BS-RGCN	.621	<b>.647</b>	<b>.556</b>	<b>.701</b>	<b>.717</b>

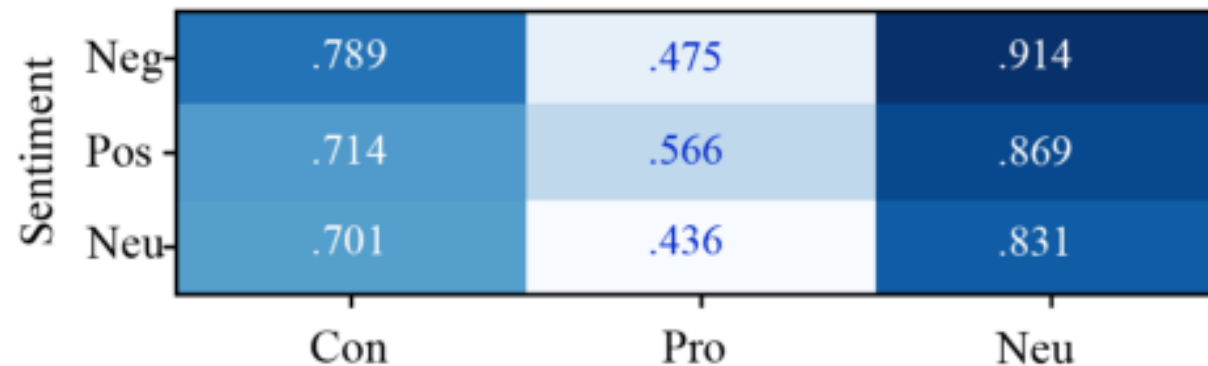
Table 3: Accuracies on five challenges on the test set.



# Experiments



(a) B-RGCN



(b) BS-RGCN (Ours)



# Experiments

Context	Topic	Gold Label	Output
I have lived in brazil for the last five years ( and off and on over the last 27 years ). I know of no one here who is even remotely excited about the Olympics. It would seem that people don't care. The economy is <b>tanking</b> and government is at a complete <b>standstill</b> . We have more important things on our mind right now.	Olympics	Con	Con
I can't even believe that this is a debate. Cutting the most basic <b>foreign language programs</b> ? How does one appreciate that there is a world outside of America? Google translate? Suny, everyone is laughing at you and you're too smug to notice.	College	Con	Con
Good idea. I have always had a cat or two. While being <b>inhumane</b> , <b>declawing</b> places a cat in danger. Should my charming indoor kitty somehow escape outside, he would have no way to defend himself.	nail removal	Con	Con

Table 4: Case Study for our trained stance detection model. Case I shows the effectiveness of using sentiment information; Case II shows the importance of commonsense knowledge; Case III shows both the sentiment and commonsense knowledge help the stance detection model.

# Experiments

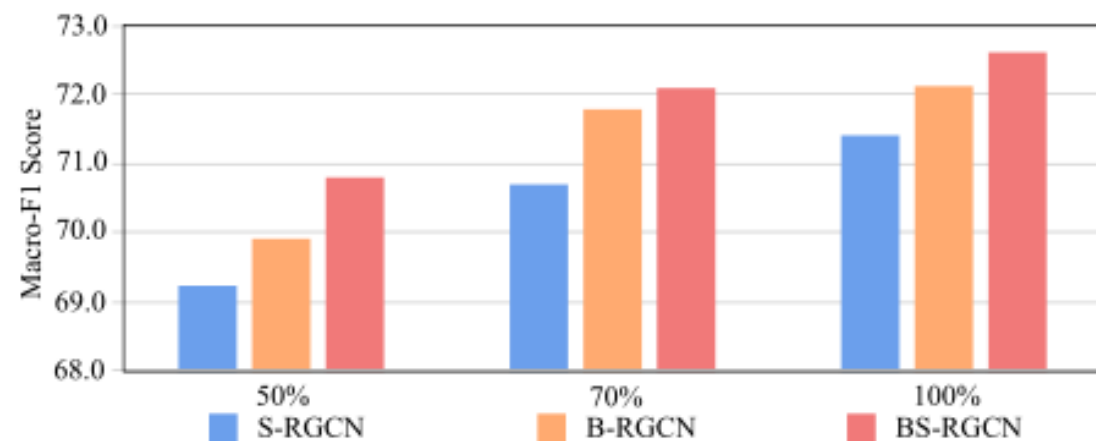


Figure 4: Accuracies of S-RGCN, B-RGCN, and BS-RGCN on test data w.r.t different percents of common-sense knowledge for pre-training.



# Experiments

Context	Topic	Stance	Relation
The reason that <b>Deep Mind</b> winning is so <b>impressive</b> is that Google managed to accomplish this with virtually no warning. It was less than a year ago where the <b>best computer program</b> was not in the top 20,000 in the world. It was less than 6 months ago when the program beat a player in the top 1,000. Yesterday the program beat the the best player in the world. Am I wrong to be shocked at how <b>fast</b> complicate <b>AI</b> has advanced?	Artificial In- telligence	Pro	+
I totally agree with this premise. As a younger person I was against <b>Nuclear power</b> (I was in college during 3 mile island) but now it seems that nuclear should be in the mix. Fission technology is <b>better</b> , and will continue to get <b>better</b> if we actively promote its development. The <b>prospect</b> of fusion energy also needs to be explored. If it's <b>good</b> enough for the sun and the stars, it's <b>good</b> enough for me.	Nuclear Power	Pro	+
This is a horrible idea. Anyone who has worked on the border, or in <b>Mexico</b> (as I do), knows there are plenty of middle and upper-class Mexicans who come to the U.S. for an education. I think Dr. Lee is really perpetuating stereotypes here. In my opinion, affirmative action should be based on economic class, no matter what the race.	Mexico	Pro	0
Good idea. I have always had a cat or two. While being <b>inhumane</b> , <b>declawing</b> places a cat in danger. Should my charming indoor kitty somehow escape outside, he would have no way to defend himself. Why don't humans have their finger- and tonails removed to save on manicures? Answer: they are important to the functioning and protection of our bodies.	nail removal	Con	+
The mandate of <b>private corporations</b> is to make a profit. And if the profit is made at the EXPENSE of the society that allow the <b>corporation</b> to exist, well, <b>too bad</b> . <b>Oil companies</b> <b>foul</b> the environment. <b>Financial companies</b> drive the economy into the Great <b>Recession</b> . <b>Airlines</b> have no regard for the people they transport. As long as they make a profit, they are allowed to <b>abuse</b> the public until they are stopped. That is the way it has been since Swift and Armour canned and sold rotten meat and Carnegie sent Pinkertons to shoot striking miners.	private corporation profit	Con	+





# Experiments

One's own, and learning another language is important and a great work out for the brain! Back in the day, I learned Spanish! In retrospect <b>Latin</b> would have been the <b>better</b> way to go, since mastery of that makes learning the languages like French, Italian, Portuguese, Romanian, and Spanish, very much easier to learn!	Latin helpful language	Pro	+
Without government to ensure their behavior, <b>companies</b> will attempt to make a profit even to the DETRIMENT of the society that supports the business. We have seen this in the environment, in finances, in their treatment of workers and customers. Enough.	company	Pro	0
The "you have a short live, so enjoy" attitude alone did not lead to the <b>Renaissance</b> , the age of Enlightenment, or the Industrial Revolution. It did not lead to the invention of the light bulb, or the telephone, or the internet, or the NYT electronic discussion board. Just "enjoying" life alone means you are enjoying the fruit of someone else's hard work.	Renaissance	Pro	0
Of course their salaries should be raised. But this should be separated from the discussion about legality. Salaries should be raised and only legal workers should be employed. Its really a no brainer. And any discussion about only Mexicans being prepared to do this work so it has to be <b>illegal</b> is completely <b>disingenuous</b> .	illegal labor	Con	+
Also, and usually not acknowledged, is that we are slowly eroding the fertility of the soil. There is no more usable <b>soil</b> , we are farming everything that can be farmed. Current methods depend on petrochemical fertilizers. Even with their use, <b>fertility</b> is slowly <b>declining</b> . As human population continues to grow, the result is obvious.	soil	Con	+



**Thank you !**