

Outline

Motivation

Experiment

Results

Conclusion and Future Work

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Framework

- ▶ REAP: tutor for ESL vocabulary learning
- ▶ Authentic documents from the Web
- ▶ Uses cloze questions (fill-in-the-blank)
- ▶ Target words in the readings
- ▶ Questions about the target words

Lecture 14. The causes of booms and busts
from the *Economist*

The business cycleboom and bust. Economists still cannot agree about what causes contractions and expansions in economic activity.

Two main explanations: the business cycle as a self-perpetuating process, or shocks and policy mistakes. The main theories are:

Exogenous shocks: Recessions are caused by **unexpected events**, such as the rise in oil prices in the mid-1970s or, as some tried to argue, the terrorist attacks on September 11th last year. If so, recessions are, by definition, totally unpredictable. They cannot be prevented, but once they have arrived governments can use fiscal and monetary policies to cushion demand.

Keynesian theory: John Maynard Keynes blamed recessions on the inherent instability of investment caused by animal spirits: **swings in the mood of producers, from optimism to pessimism**. As investment slumps, jobs and household incomes fall, amplifying the initial drop in demand. Unemployment rises because workers will not accept the pay cuts required to price the jobless back into work. So, to bring the economy back to full employment, the government needs to **pursue** expansionary policies.

Real business-cycle theory: This theory, which emerged in the early 1980s, sees **productivity shocks** as the cause of economic fluctuations. For example, if productivity falls, current returns decline, so workers and firms choose to work less and take more leisure. Rather than explaining the cycle in terms of market failure, as Keynes did, real business-cycle theory views a recession as the optimal response by households and firms to a shift in productivity. If so, there is no point in governments stimulating the economy. But most economists find this theory hard to swallow. Mike Mussa, a former chief economist at the IMF, describes it as the theory according to which the 1930s should be known not as the Great Depression, but the Great Vacation.

Policy mistakes: The late Rudi Dornbusch, an economist at the MIT, once remarked: None of the postwar expansions died of old age, they were all murdered by the Fed. Almost every recession since 1945, with the exception of last year's, was preceded by a sharp rise in inflation that forced central banks to raise interest rates. The first mistake was to allow economies to overheat; the second to slam on the brakes too hard. This theory gave rise to the popular belief that recessions could be avoided so long as governments **pursued** prudent monetary policies to keep inflation low and stable. Yet the recessions in Japan after the 1980s bubble and America now suggest that price stability does not prevent booms and busts.

Austrian business-cycle theory: This is the oldest, developed by Austrian economists such as Ludwig von Mises and Friedrich Hayek in the early 20th century. Unlike Keynes, who thought recessions were caused by insufficient demand, these economists put them down to **excess supply** brought about by **overinvestment**. As a result of **mutually** reinforcing movements in credit, investment and profits, each boom contains the seeds of the subsequent recession and each recession the seeds of the subsequent boom.

Output fluctuates because the short-term interest rate for loans diverges from the natural or equilibrium interest rate at which the supply of saving from households equals the demand for investment funds by firms. If central banks hold interest rates below this rate, credit and investment will rise too rapidly, and consumers will not save enough. This creates a mismatch between future **output** (which will increase as a result of higher investment) and future spending (which will fall as a result of lower saving today). **Cheap credit and inflated profit expectations cause both overinvestment and malinvestment in the wrong kind of capital.** The mismatch between saving and investment will eventually push up interest rates, making some previous investments unprofitable. Too much capacity will also reduce profits. Investment **collapses**, ushering in a recession. As excess capacity is cut, profits rise and investment eventually recovers.

According to this theory, central banks would not be able to avoid a downturn by heading off a rise in interest rates. The only way to prevent the cycle from turning is to inject ever more credit, which becomes **unsustainable**. A recession is **inevitable**, and indeed necessary to correct the imbalance between saving and investment.

Look up a word

20 minutes left

Done reading →



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Look up a word

20 minutes left

Done reading →



Select the word that best completes the sentence.

John saw the man ____ from utter exhaustion and lack of food.

- collapse
- occur
- priority
- reverse
- trace

Done

Look up a word

“John saw the man **collapse** from utter exhaustion and lack of food.”

Document: “Investment **collapses**, ushering in a recession.”

Question: “John saw the man **collapse** from utter exhaustion and lack of food.”

Other possibilities

- ▶ The building could **collapse** if there is an earthquake.
(different meaning)

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- ▶ Social services for these very poor people will **collapse** if more money isn't provided by the central government. (related meaning)

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- ▶ The building could **collapse** if there is an earthquake. (different meaning)
- ▶ Social services for these very poor people will **collapse** if more money isn't provided by the central government. (related meaning)
- ▶ The economy will **collapse** completely if this fighting continues. (same meaning)

Goal

Control how the meaning of a target word in a question relates to the meaning of this target word in a document

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Control how the meaning of a target word in a question relates to the meaning of this target word in a document

Make the meanings match

- ▶ Given a document \mathbf{d} containing the word \mathbf{w} with meaning \mathbf{m}
- ▶ Given n questions $\mathbf{q}_1, \dots, \mathbf{q}_n$ about \mathbf{w} with meanings $\mathbf{m}_1, \dots, \mathbf{m}_n$
- ▶ Find the questions \mathbf{q}_i such that $\mathbf{m}_i = \mathbf{m}$

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- ▶ Find the questions \mathbf{q}_i such that $\mathbf{m}_i = \mathbf{m}$
- ▶ Simpler: find at least one question \mathbf{q}_i such that $\mathbf{m}_i = \mathbf{m}$

Algorithms

- ▶ Lesk
- ▶ Latent Semantic Analysis (LSA)
- ▶ Suitable for discrimination rather than disambiguation

Lesk (one variant)

- ▶ Word \mathbf{w} in sentence \mathbf{s} .
- ▶ \mathbf{w} has definitions $\mathbf{d}_1, \dots, \mathbf{d}_n$ in a dictionary.
- ▶ Select context \mathbf{c} for \mathbf{w} (e.g. \mathbf{s} or words around \mathbf{w}).
- ▶ Select the definition that has the most words in common with \mathbf{c} .

Lesk for this task

- ▶ Word \mathbf{w} in document \mathbf{d} .
- ▶ \mathbf{w} has questions $\mathbf{q}_1, \dots, \mathbf{q}_n$.
- ▶ Select contexts \mathbf{c}_d and \mathbf{c}_q for \mathbf{w} in \mathbf{d} and in \mathbf{q} .
- ▶ Select the question that has the most words in common with \mathbf{c} .

Latent Semantic Analysis (LSA)

- ▶ Challenge: the questions are a short context
- ▶ LSA: initially LSI, used to match (short) queries to documents

LSA Description

- ▶ X : term-document matrix (e.g. $X_{i,j} = 1$ if word i appears in document j)
- ▶ $X = U \cdot S \cdot V^T$ (SVD theorem)
- ▶ $U^T \cdot U = I_m$ and $V^T \cdot V = I_n$
- ▶ U is truncated, replaced by U_r , V replaced by V_r , S replaced by S_r
- ▶ $X \simeq U_r \cdot S_r \cdot V_r^T$
- ▶ Similarity between \mathbf{d} and \mathbf{q} : compute cosine similarity between $S_r^{-1} \cdot U_r^T \cdot \mathbf{d}$ and $S_r^{-1} \cdot U_r^T \cdot \mathbf{q}$

Motivation

- ▶ Cope with sparsity
- ▶ Remove noise

Motivation

- ▶ Cope with sparsity
 - ▶ Compute similarity in another space
- ▶ Remove noise
 - ▶ truncated SVD

Experimental Goal

- ▶ Compare LSA performance for words with related and unrelated meanings to a random baseline and Lesk
 - ▶ Example (related meaning): comprise
 - ▶ Example (unrelated meaning): bank

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Setup

- ▶ 62 manually generated cloze questions
- ▶ 16 target words (e.g. bond, collapse, compound, comprise, etc.)
- ▶ Senses manually annotated (WordNet)
- ▶ Web documents containing target word/sense gathered

Factors Studied

- ▶ Words with related and unrelated meanings vs. with unrelated meanings only
- ▶ Truncation parameter
- ▶ Context selection

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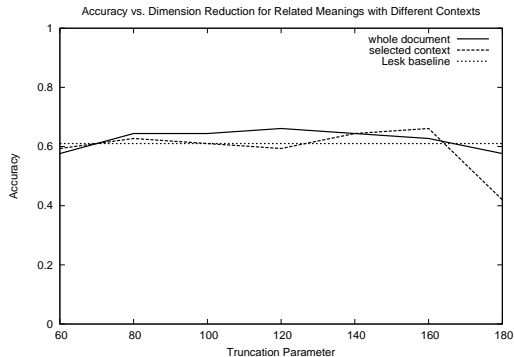
Results

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Baseline

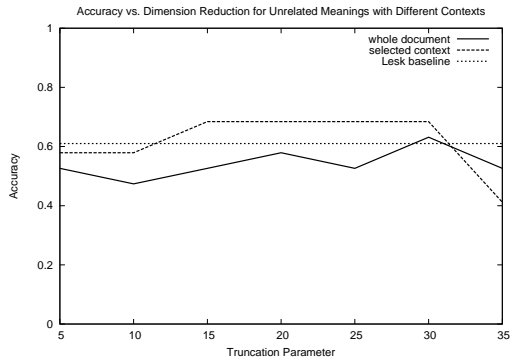
- ▶ Random Baseline: 44%
- ▶ Lesk Algorithm: 61%
- ▶ Lesk preprocessing
 - ▶ lower casing
 - ▶ stemming
 - ▶ stop words and punctuation discarded
 - ▶ window: 10 words around the target in the question
 - ▶ window: 2 sentences around the target in the document

LSA



- ▶ words with related and unrelated meanings
- ▶ LSA better only with certain truncation parameter values

LSA



- ▶ words with unrelated meanings
- ▶ context selection plays important role

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- ▶ Comparison performance of Lesk, LSA and a random baseline
- ▶ Factors: truncation parameter, context selection and type (unrelated/related vs. unrelated)
- ▶ Future work: Comparison of LSA with other second-order representations of documents and questions
- ▶ Future work: use WSD to rank definitions

REAP Reading - Mozilla Firefox

http://reap-2.cs.cmu.edu/summer09/present_group_reading.php?username=jmpino4&sessionid=64&schema=reap_summer09&condition=0&calloutwords=6&calloutpos=6&calloutroots=6&document_id=439297

Dictionary Search - Mozilla Firefox

http://reap-2.cs.cmu.edu/summer09/word_lookup.phtml?f

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 and investment.

collapse (n)

- when a person or structure becomes too weak to stand and suddenly falls
- the sudden failure of a system, organization, business, etc

collapse (v)

- to fall down suddenly because of pressure or lack of strength or support
- If someone collapses they fall down because they are ill or weak
- to fold something into a smaller shape, usually so it can be stored, or (especially of furniture) to fold in this way
- (of people and business) to suffer the sudden inability to continue or work correctly

Examples:

- He was taken to hospital after his collapse on the pitch.
- the collapse of a tower block during the earthquake
- I don't know what caused the collapse [of] her marriage.
- A poor economy has caused the collapse [of] thousands of small businesses.
- Negotiations between the two countries are [on the brink/verge of] collapse (very soon going to fail).

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Look up a word

18 minutes left Done reading-->

Done

Thank you. Questions?

Words and questions with annotated senses available at
www.cs.cmu.edu/~jmpino/questions.xls