



Google Translate: Inside and Out

Keith Stevens - Software Engineer

2016/10/29

Our Mission

High quality translation when and where you need it.



Access Information



Communicate



Learn

Access Information

Terminologie [[modifier](#) | [modifier le code](#)]

Le terme moulin à vent n'est habituellement utilisé que pour les ouvrages relativement anciens des pays riches et les installations à techniques anciennes des régions moins développées. Abandonnés dans les pays développés avec la généralisation de l'électricité, il est l'ancêtre de l'éolienne et ne se distingue dans son principe que par l'existence d'un bâtiment servant de support aux ailes et d'abris pour les mécanismes et l'activité meunière. L'abandon de l'énergie éolienne pour mouvoir des meules, et les débuts de son utilisation pour actionner des générateurs électriques sont concomitants à ce basculement de vocabulaire comme le montre la continuité de l'usage pour actionner directement des pompes. De même l'utilisation alternative des termes *pale* ou *aile* ne se justifie sans ambiguïté par aucun critère technique.

Histoire [[modifier](#) | [modifier le code](#)]

Le moulin à vent est utilisé en *Perse* pour l'irrigation dès l'an 600. Il est apparu^[Quand ?] sur le territoire de l'ouest de l'actuel *Afghanistan*, notamment à *Nashtifan* (*en*), dans la province du *Khorasan*, surnommée l'« ancienne ville des moulins ». Les moulins perses, découverts en Palestine par les *Croisés*¹, n'étaient pas du même type que les moulins européens. Ils étaient constitués d'une *éolienne à axe vertical*, confinée à l'intérieur du moulin². Des orifices dans les parois du moulin permettent à l'air de s'engouffrer pour actionner l'éolienne.

Access Information

The windmill term is usually used for relatively old works of rich and ancient techniques to facilities in less developed regions. Abandon

ancestor of the wind and do
and shelter for mechanisms
the beginnings of its use to p
continuous use for operating
unambiguously by no techni



Original text

Le terme moulin à vent n'est habituellement utilisé que pour les ouvrages relativement anciens des pays riches et les installations à techniques anciennes des régions moins développées.

[Contribute a better translation](#)

History [change | modify the source]

The windmill is used in [Persia](#) for [irrigation](#) in the year 600 . It appeared ^[when?] On the western territory of present [Afghanistan](#) , including [Nashtifan](#) (ناشتيفان) in the province of [Khorasan](#) nicknamed the "old town mills." Persian mills, discovered in Palestine by the [Crusaders](#) ¹ , were not of the same type that European mills. They consisted of a [vertical axis wind](#) confined inside the mill ² . Holes in the walls of the mill allow the air to rush for actuating the wind turbine.

Access Information

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sports.williamhill.com/

अनुवादित: **विलियम हिल** से ऑनलाइन सट्टेबाजी - 1934 के बाद से सट्टेबाजी का घर

Enjoy online betting at **William Hill**, UK's top betting site. Get the best live betting odds and sports action round the clock. Sign up and place your bets now!

विलियम हिल से ऑनलाइन सट्टेबाजी - 1934 के बाद से सट्टेबाजी का घर

sports.williamhill.com/

William के लिए खोजे गए अंग्रेज़ी दस्तावेज़ का अनुदित परिणाम

विलियम हिल, ब्रिटेन के शीर्ष सट्टेबाजी साइट पर ऑनलाइन सट्टेबाजी का आनंद लें. सबसे अच्छा रहने सट्टेबाजी बाधाओं और खेल कार्रवाई चौबीसअँ घंटे जाओ. ऊपर करें और अपने दांव लगाएं!

Communicate

Police use translation app to aid diabetic driver



  Tweet 5  Recommend 11  +1  Ricard  MORE

by Frank Mungeam

[Bio](#) | [Email](#) | Follow: @KGWNews

Posted on February 13, 2012 at 4:54 PM

Updated Tuesday, Feb 14 at 1:10 PM

THE DALLES, Ore. -- A mobile app helped Oregon State Police troopers communicate with a foreign-speaking man who was experiencing a diabetic reaction while driving on I-84 near The Dalles.

On Sunday afternoon, OSP troopers responded to several reports of a possible impaired driver traveling westbound on I-84 from the Pendleton area. Troopers saw and stopped the vehicle just after 3 p.m. near The Dalles.

The driver, a 57-year-old man of Chinese descent, spoke little English so the troopers used a Google language translator app to discover that the man was diabetic. The cell phone app translates more than 50 languages in text or spoken word.

Local emergency medical personnel responded and confirmed the man's blood sugar level was abnormally high and he was undergoing a diabetic reaction, according to police.

The man was taken to Mid-Columbia Medical Center and his son, who lives in Seattle, was contacted and drove to the hospital to pick his father up.

10:33



Roommates

Aneesh, Riya, You



Aneesh

Hey guys 10:27 AM

Riya

शुभ शुक्रवार! 10:29 AM



Type a message



Learn



verb

membuntuti
trail, tail, tag, heel, shadow, dog

mengikuti
follow, attend, take, keep up, adhere,
dog

Definitions of dog

noun

a domesticated carnivorous mammal that typically has a long snout, an acute sense of smell, and a barking, howling, or whining voice. It is widely kept as a pet or for work or field sports.

"Shouts mingle with the barking and howling of dogs ."

synonyms: hound, canine, mongre...

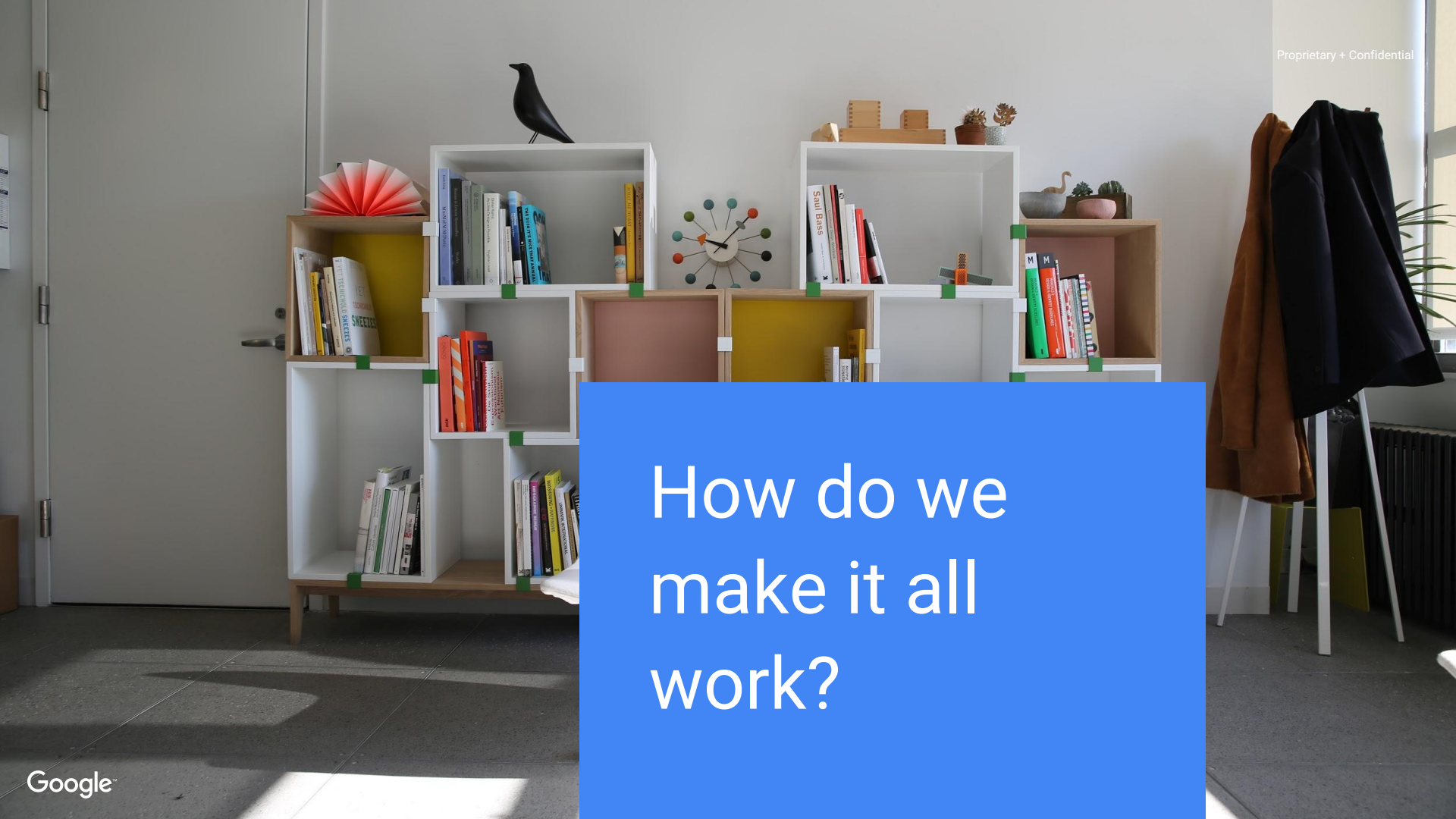
a person regarded as unpleasant, contemptible, or wicked (used as a term of abuse).

"come out, Michael, you dog!"

verb

follow (someone or their movements) closely and persistently.

"photographers seemed to dog her every step"



How do we
make it all
work?

Step by Step

Input

Vietnamese



English

Một thứ tiếng thì không bao giờ đủ

Step by Step

Input

Vietnamese



English

Segment

Một

thứ tiếng

thì không bao giờ

đủ

Step by Step

Input

Segment

Phrase
Translation

Vietnamese



English

Một

thứ tiếng

thì không bao giờ

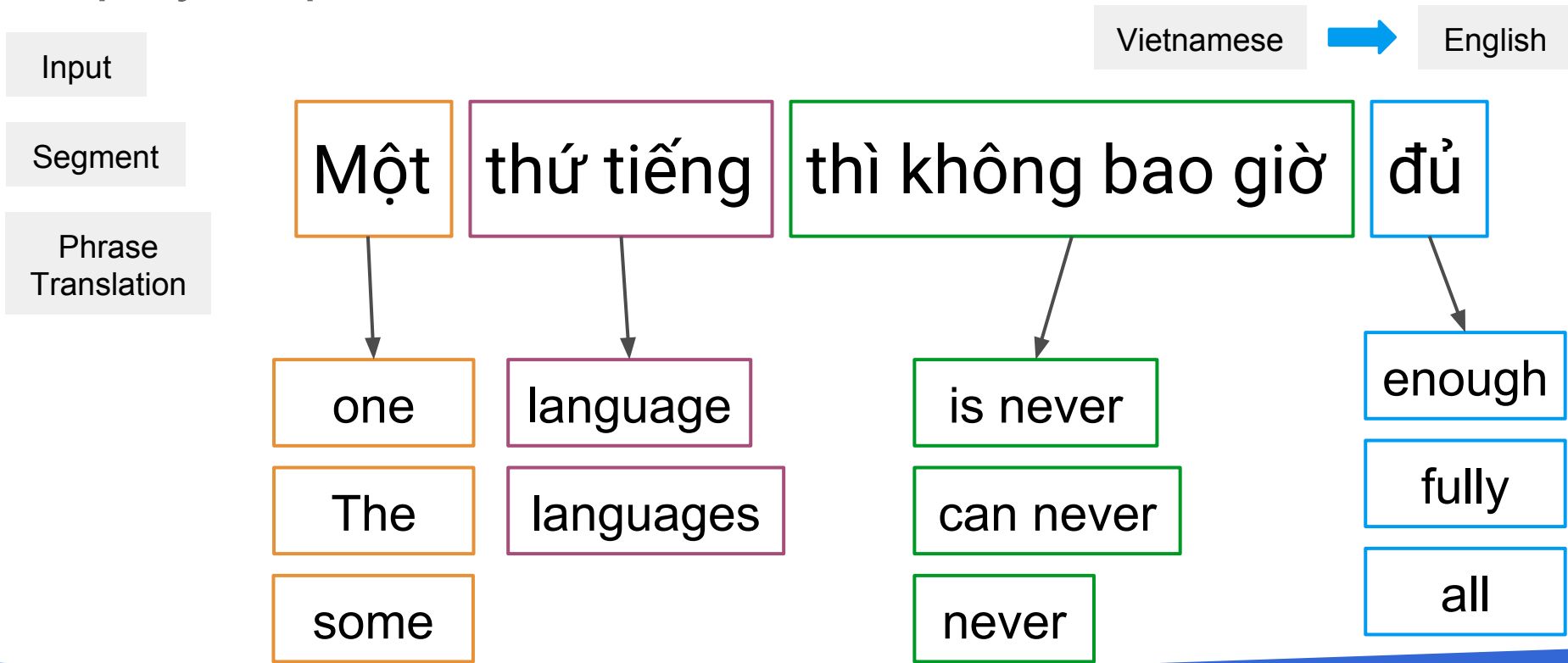
đủ

enough

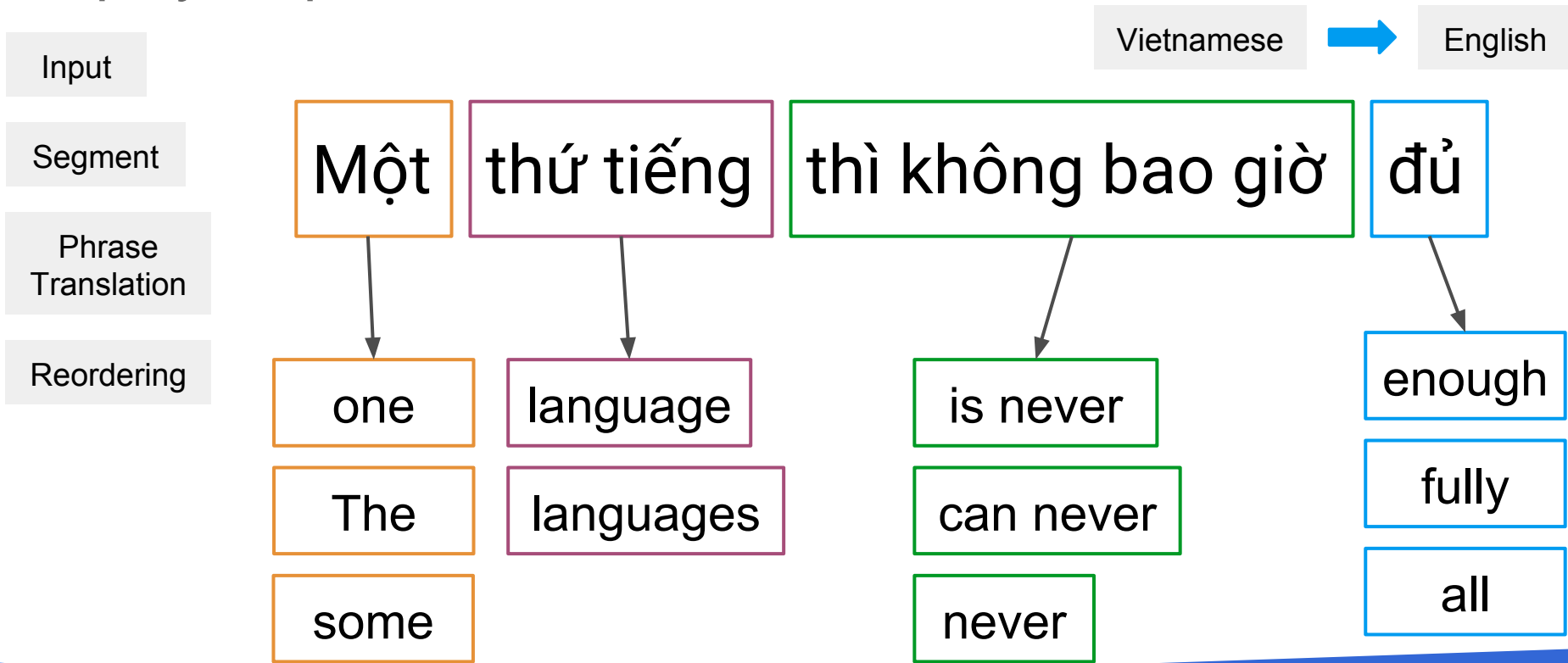
fully

all

Step by Step



Step by Step



Step by Step

Input

Vietnamese



English

Segment

Một thứ tiếng thì không bao giờ đủ

Phrase
Translation

Reordering

one language is never enough

0.987

Search

the languages never fully

0.815

some never all

0.512

Step by Step

Input

Vietnamese



English

Segment

Một

thứ tiếng

thì không bao giờ

đủ

Phrase
Translation

Reordering

one language is never enough

Search

Output

Step by Step

Input

Vietnamese



English

Segment

Một thứ tiếng thì không bao giờ đủ

Phrase
Translation

one language is never enough

Reordering

Search

Output

$$P(e|g) = P(\{\bar{g}_i\}|g) \prod_i P(\bar{e}_i|\bar{g}_i) P(a_i - b_{i-1})$$



Segmentation



Translation



Distortion

Learning what we know

CLASSIC SOUPS

Sm.

Lg.

清 燉 雞 湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot)	1.50	2.75
雞 飯 湯	58.	Chicken Rice Soup	1.85	3.25
雞 麵 湯	59.	Chicken Noodle Soup	1.85	3.25
廣 東 雲 吞	60.	Cantonese Wonton Soup	1.50	2.75
蕃 茄 (蛋) 湯	61.	Tomato Clear (Egg Drop) Soup	1.65	2.95
雲 吞 湯	62.	Regular Wonton Soup	1.10	2.10
酸 辣 湯	63.	Hot & Sour Soup	1.10	2.10
(蛋) 花 湯	64.	(Egg Drop) Soup	1.10	2.10
雲 (蛋) 湯	65.	(Egg Drop) Wonton Mix	1.10	2.10
豆 腐 菜 湯	66.	Tofu Vegetable Soup	NA	3.50
雞 玉 米 湯	67.	Chicken Corn Cream Soup	NA	3.50
蟹 肉 玉 米 湯	68.	Crab Meat Corn Cream Soup	NA	3.50
海 鮮 湯	69.	Seafood Soup	NA	3.50

CLASSIC SOUPS

Sm.

Lg.

清 燉 雞 湯 57.

雞 飯 湯 58.

雞 麵 湯 59.

廣 東 雲 吞 60.

蕃 茄 蛋 湯 61.

雲 吞 湯 62.

酸 辣 湯 63.

蛋 花 湯 64.

雲 蛋 湯 65.

豆 腐 菜 湯 66.

雞 玉 米 湯 67.

蟹 肉 玉 米 湯 68.

海 鮮 湯 69.

House Chicken Soup (Chicken, Celery,

Potato, Onion, Carrot) 1.50

Chicken Rice Soup 1.85

Chicken Noodle Soup 1.85

Cantonese Wonton Soup 1.50

Tomato Clear Egg Drop Soup 1.65

Regular Wonton Soup 1.10

Hot & Sour Soup 1.10

Egg Drop Soup 1.10

Egg Drop Wonton Mix 1.10

Tofu Vegetable Soup NA

Chicken Corn Cream Soup NA

Crab Meat Corn Cream Soup NA

Seafood Soup NA

2.75

3.25

3.25

2.75

2.95

2.10

2.10

2.10

2.10

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Tofu Vegetable Soup

Chicken Corn Cream Soup

Crab Meat Corn Cream Soup

Seafood Soup

1.50 2.75

1.85 3.25

1.85 3.25

1.50 2.75

1.65 2.95

1.10 2.10

1.10 2.10

1.10 2.10

1.10 2.10

NA 3.50

NA 3.50

NA 3.50

NA 3.50



Filling in Gaps

Such Obvious Mistakes

English



Vietnamese

Where the Wild Things Are



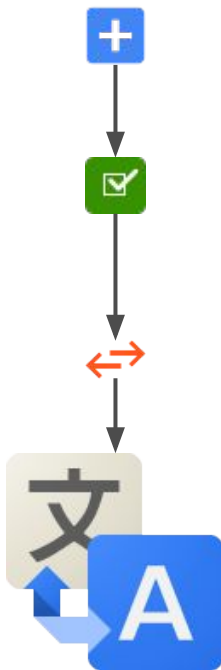
Where the Wild Things Are

Not Quite
Right

Fixing mistakes with Crowdsourcing



Google Translate
Community



Translate “where am I?”

Validate “¿Dónde estoy?”

Compare two translations

Serve to real users

Fixing mistakes with Crowdsourcing



Google Translate
Community

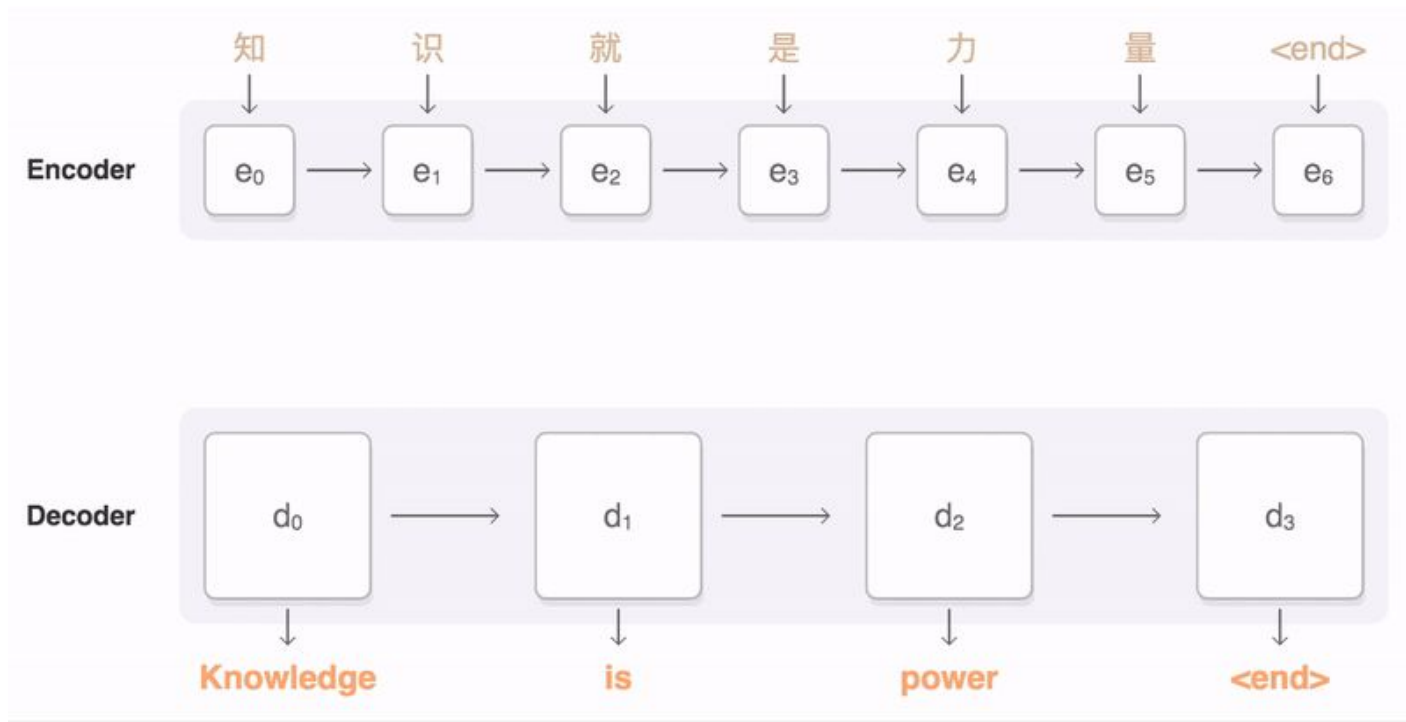
Who speaks each language?

Who can we trust?

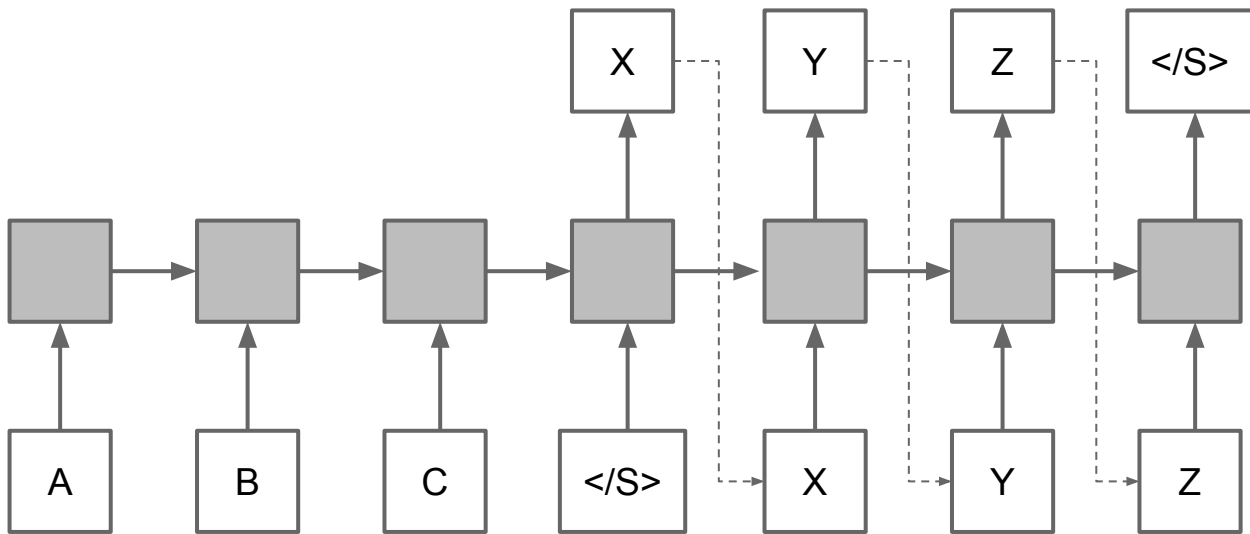
If we don't know how the answer,
how do we test users?

Going to the Future of Translation

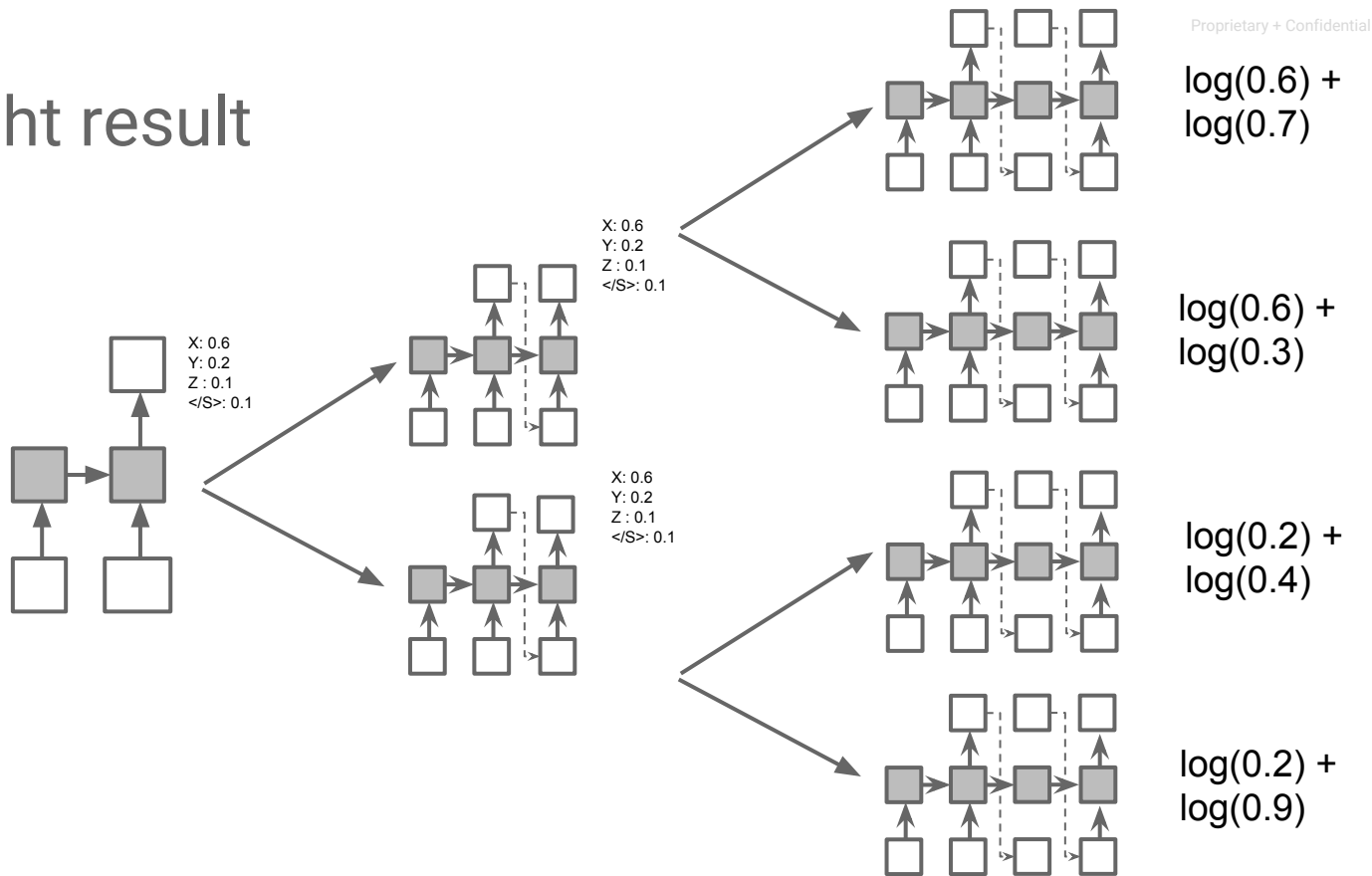
Neural Machine Translation



Long Short Term Memory




Finding the right result



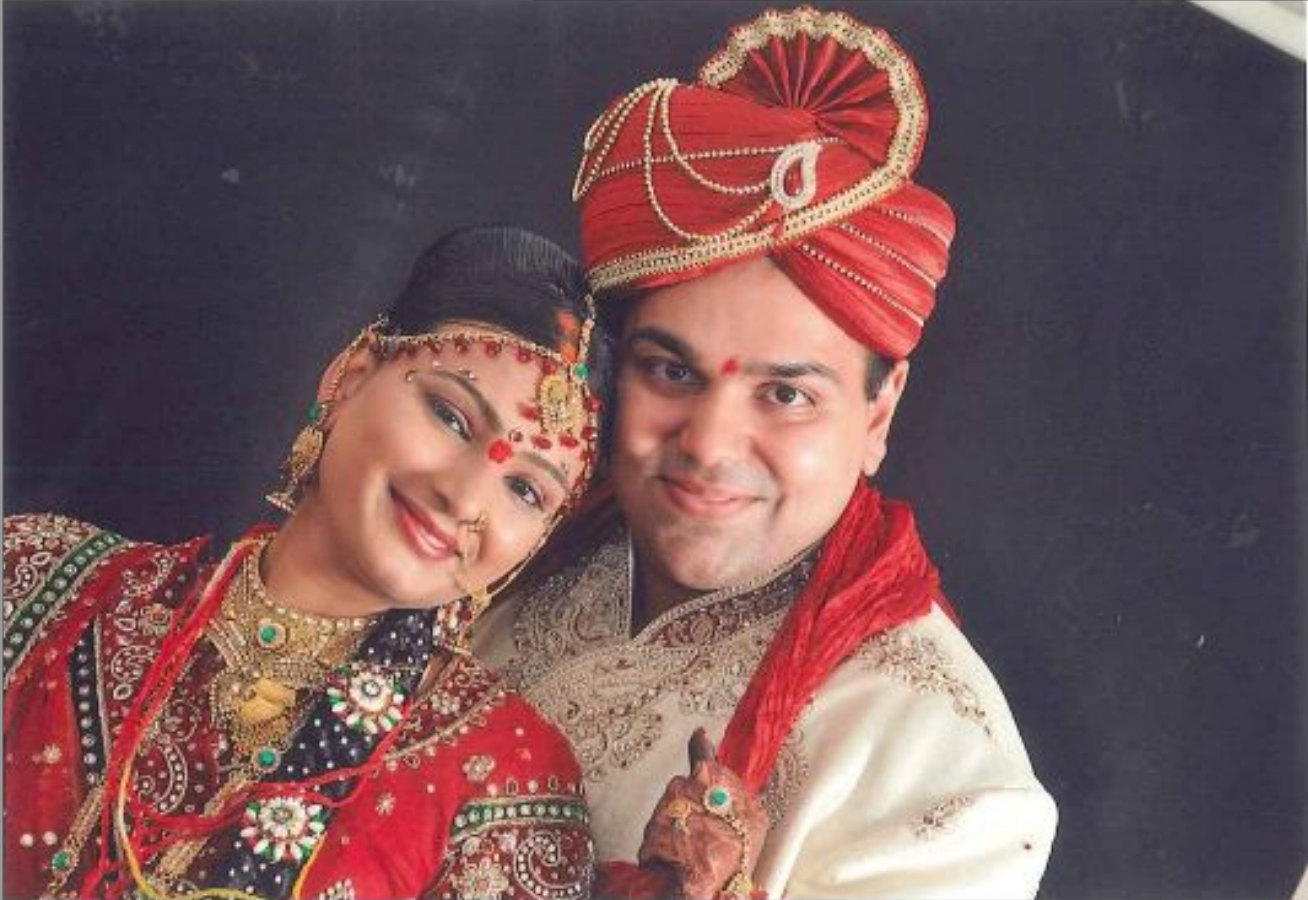
Not the only use for Neural Networks





A modern, modular white shelving unit with various decorative items and books. The unit is composed of several white cube-shaped shelves of different sizes, some of which are filled with books. On top of the unit, there is a black bird sculpture, a small clock with colorful dots, and some wooden blocks. To the right of the unit, there is a coat rack with a brown coat and a black jacket hanging on it. The background is a plain white wall, and the floor is a dark grey tile.

What's after
this?



“Google Translate helped change my life and gave me the best thing that has ever happened to me, Love.”

THANK YOU

Appendix

Starting to work on a new language

Find translators to translate 100,000 words

Four Lao translators; approx. 50 work days total

Use for training and evaluation

Measure similarity of human and system translations

Train a language detector to find more data

11 billion Lao words



Human Translations
100,000 words



Automatically-Mined Lao Text
11 billion words



Automatically-Mined Lao Text
11 billion words

Training a First Translation System

200 trillion English words and 11 billion Lao words

Initially without a dictionary

Use same strings, URL patterns

Use machine learning to find co-occurrence patterns

ຈີນ = "China"

Raise \$100,000 for education
in India, Pakistan and China

ລວບລວມເງິນ 100,000
ໂດລາສໍາລັບການສຶກສາໃນອິນເດຍ,
ປາກິດສະຖານແລະຈີນ

Universal Serial Bus (USB)
connects more than
computers and peripherals.

ຢູເອັສບີ (USB) ເຊື່ອມຕໍ່ຫຼາຍກວ່າຄອ
ມພິວເຕີແລະເຄື່ອງປະກອບຄອມພິວເຕີ.

www.beerlao.la/lao/main.php

www.beerlao.la/eng/main.php



**Automatically-Mined
Lao-English Translations**
20 million words

27 août 2012

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Le meilleur de la presse européenne

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Politique ▶ La vie des 27 ▶

LANGUES

Bruxelles en manque de traducteurs

8 août 2012 [presseurop](#) Süddeutsche Zeitung

"Un service de langues qui bégaie", titre la *Süddeutsche Zeitung*, qui [rapporte](#) que les institutions européennes à Bruxelles craignent "une situation babélique". Car la capitale européenne, où 2 500 traducteurs polyglottes convertissent tous les papiers, projets, recommandations et décisions dans les 23 langues officielles de l'Union – soit 2,2 millions de pages en 2011 –, se heurte à un manque de traducteurs compétents, notamment vers l'anglais.

Depuis que l'enseignement obligatoire des langues étrangères a été abandonné au Royaume-Uni [en 2002], l'intérêt pour d'autres langues faiblit.

De plus, si l'intérêt pour les "grandes langues" reste constant sur le continent, c'est la traduction des "petites" qui pose problème.

Trouver des traducteurs du néerlandais, de l'irlandais (gaélique) ou du maltais vers le tchèque représente un défi énorme, souvent insurmontable.

[Réagir](#) 14
[Tweeter](#) 22
[Recommander](#) 81[Partagé](#) 382 fois en 10 langues[AA+](#) [AA-](#) [Email](#) [Print](#)

SUR LE WEB

[L'article de la Süddeutsche Zeitung](#) [de](#)

C'EST VOUS QUI LE DITES

En d'autres mots : un Etat cherche à cacher ses propres crimes financiers envers ses voisins. Cet homme est le héros de la lutte contre l'argent sale.

donkey sur [L'homme qui valait des milliards](#)

Voter n'a de sens que s'il existe une véritable alternative. Les référendums ne sont pas des votes, mais plutôt de sympathiques coups d'état. Ils sont organisés pour être gagnés et désastreux quand ils sont perdus. Pourquoi ne peut-il pas y avoir un vrai choix : modèle A, B ou C ?

Gerd Schwert sur [Plaidoyer pour un référendum européen](#)

De tous les pays sujets à des problèmes, l'Italie est si riche et si

August 27, 2012

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The best of the European press

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LANGUAGES

Lack of translators in Brussels

August 8, 2012 [pressEurop](#) Süddeutsche Zeitung

"A language service who stutters," as the *Süddeutsche Zeitung*, which [reports](#) that the European institutions in Brussels fear "Babel situation." As the European capital, where 2500 multilingual translators convert all papers, projects, recommendations and decisions in the 23 official languages of the Union - 2.2 million pages in 2011 - faces a lack of competent translators, particular to English.

Since the compulsory teaching of foreign languages was discontinued in the United Kingdom [2002], interest in other languages weakens.

In addition, if the interest in "major languages" remains constant over the continent, is the translation of "small" poses problème.

Find translators in Dutch, the Irish (Gaelic) or from Maltese into Czech represents a huge challenge, often insurmountable.

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Shared 382 times in 10 languages

[A+](#) [A](#) [A-](#) [Email](#) [Print](#)

ON THE WEB

[The section of the Süddeutsche](#)

Trouver des traducteurs du néerlandais, de l'irlandais (gaélique) ou du maltais vers le tchèque représente un défi énorme, souvent insurmontable.

IT IS YOU WHO SAY

In other words: a state tries to hide its own financial crimes against its neighbors. This man is the hero of the fight against money laundering.

donkey on the man worth billions

Vote is meaningless unless there is a real alternative. Referendums are not votes, but rather friendly coups. They are organized to be earned and disastrous when they are lost. Why can not there be a real choice: model A, B or C?

Gerdswert on Plea for a European referendum

All countries prone to problems, Italy is so rich and so strong that it should

[L'article de la Süddeutsche Zeitung](#) [de](#)

[Mobile](#)[Newsletter](#)

Le meilleur de la presse européenne

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C'EST VOUS QUI LE DITES

En d'autres mots : un Etat cherche à cacher ses propres crimes financiers envers ses voisins. Cet homme est le héros de la lutte contre l'argent sale.

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The best of the European press

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LANGUAGES

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[Politics](#) [Life at 28](#)

LANGUAGES:

Brussels and the translator shortage

8 August 2012 [presseurop](#) Süddeutsche Zeitung

"A language service that is stuttering along", reports the *Süddeutsche Zeitung*, writing on the European Union institutions in Brussels that fear "a situation reminiscent of Babel". The European Union capital, where 2,500 multilingual translators convert all papers, projects, recommendations and decisions into the 23 official languages of the Union - 2.2 million pages in 2011 - is facing a shortage of translators, notably into English.

Since the compulsory teaching of foreign languages was

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Improvement over time

Improve. Iterate. Launch.

LAO SOURCE

ກະລຸນາເອົາຂໍ້ຄວາມນີ້ອອກເມື່ອສ່ວນນີ້ໄດ້ຖືກຂະຫຍາຍອອກໄປ

FEB 2012

Please get this message out as part of this has been expanded to.

SEP 2012

Please remove this message when the issue was expanded to.

FEB 2013

Please remove this message once the section has been expanded.

*ANALYZE AND FIX
TEXT PROCESSING*



FIX TRANSLATION ERRORS



IMPROVE ALGORITHM









Enhance Contrast





Find Connected Pixels





Recognize Letters





Dictionary Lookup



REUsAR EB LO MEJOR
 REDsúH E8 LO HBJOB
 REOsñB ES LO xDJ0H
 REasón EE LO KÜJ0n
 RE0s4K E6 LO uzJ0K

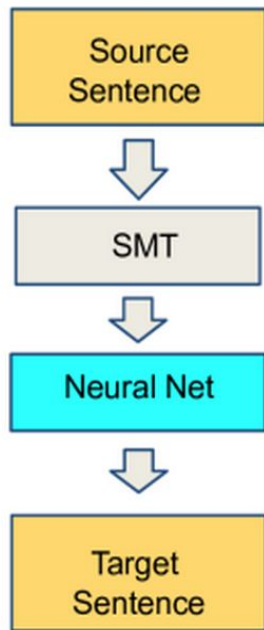
Siempre que Compres
 8iemrre que Oomrres
 BiemDre 4ue GomÜres
 GTemÜre aue eomDres
 6Zemre uue 6omQres



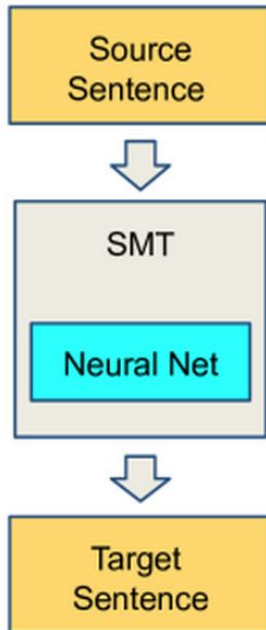
Augment Reality



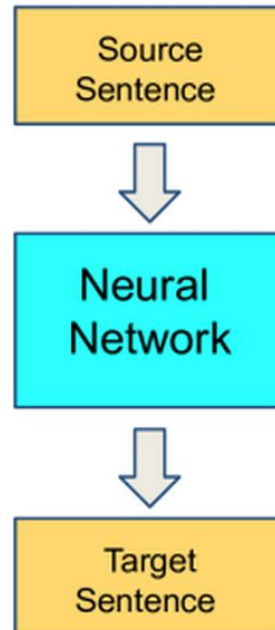
New Neural Approaches to Machine Translation



([Schwenk, CSL 2007](#))

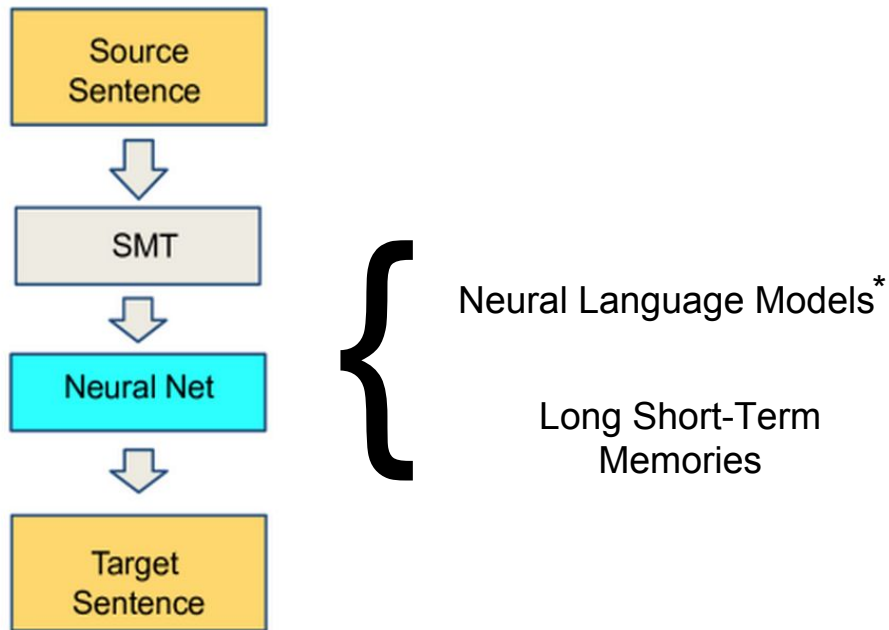


([Devlin et al, ACL 2014](#))



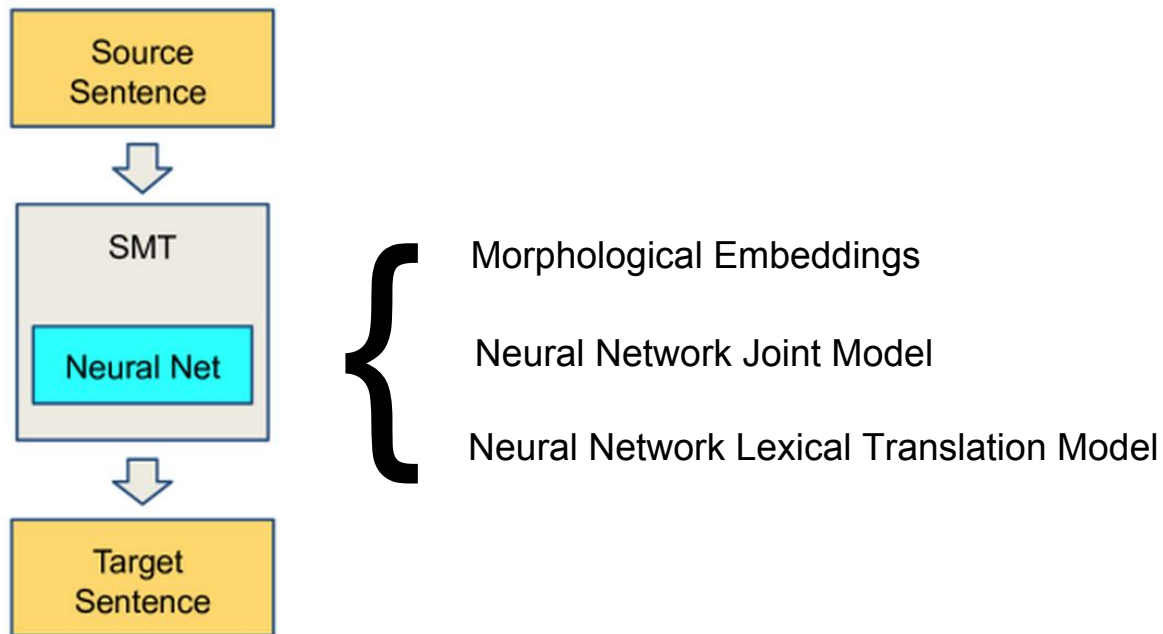
([Sutskever et al, NIPS 2014](#))

Neural Networks for scoring



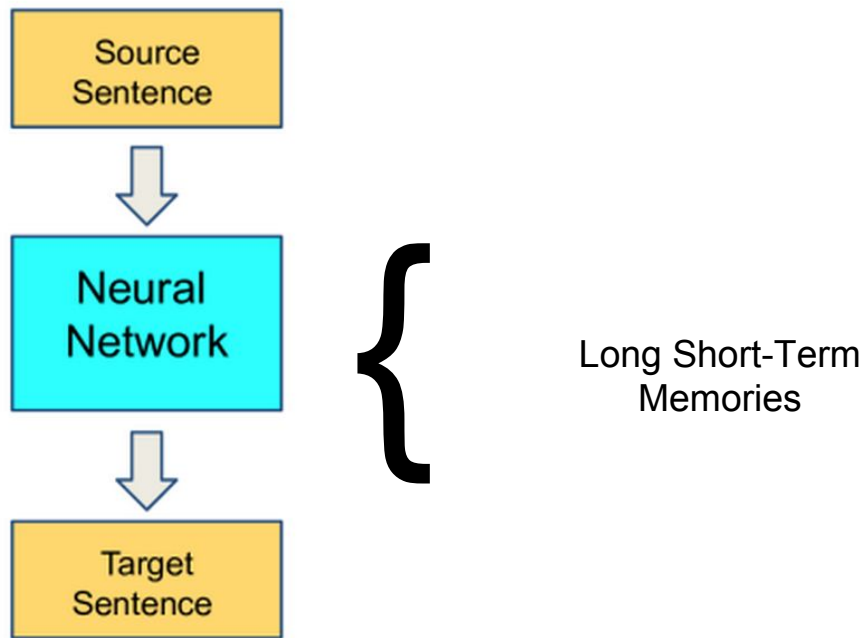
([Schwenk, CSL 2007](#))

Neural Networks as Phrase Based Features



([Devlin et al, ACL 2014](#))

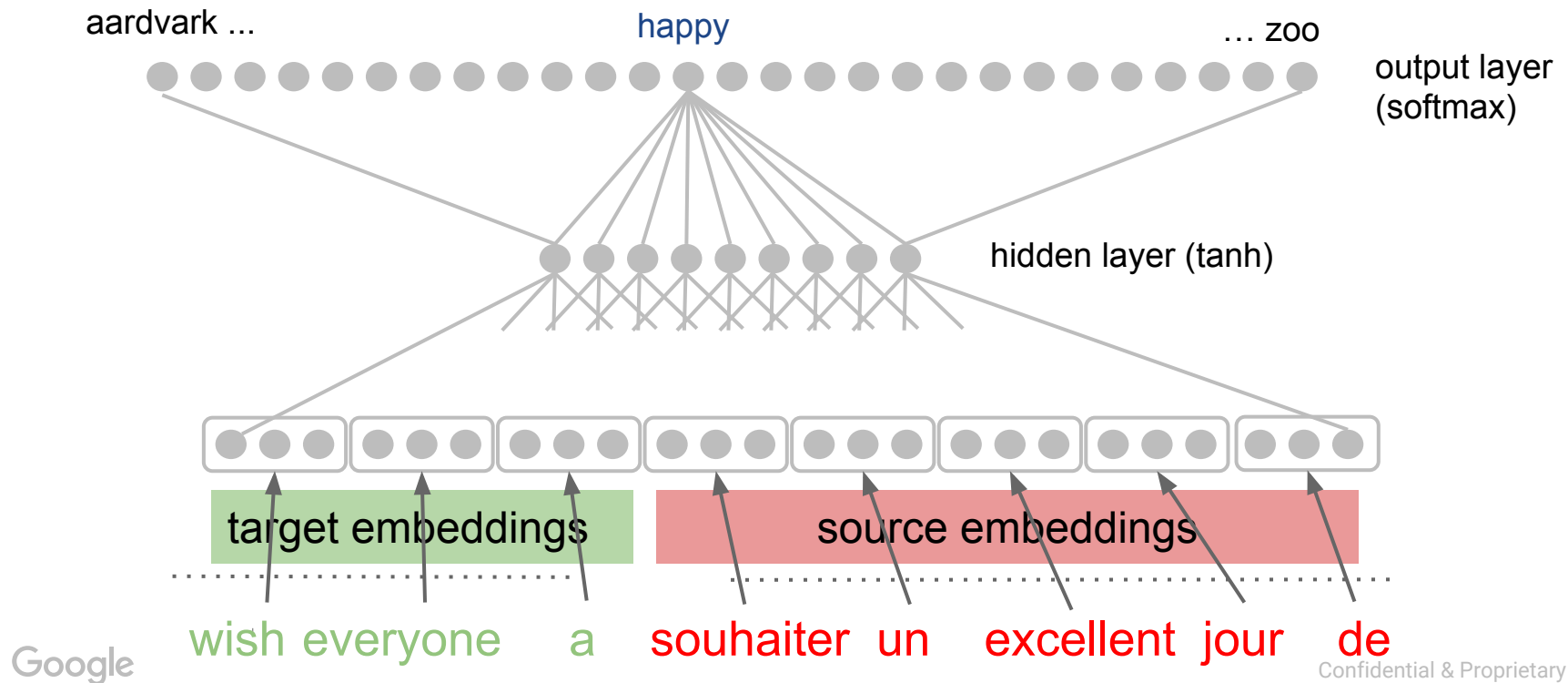
Neural Networks for all the translations



([Sutskever et al, NIPS 2014](#))

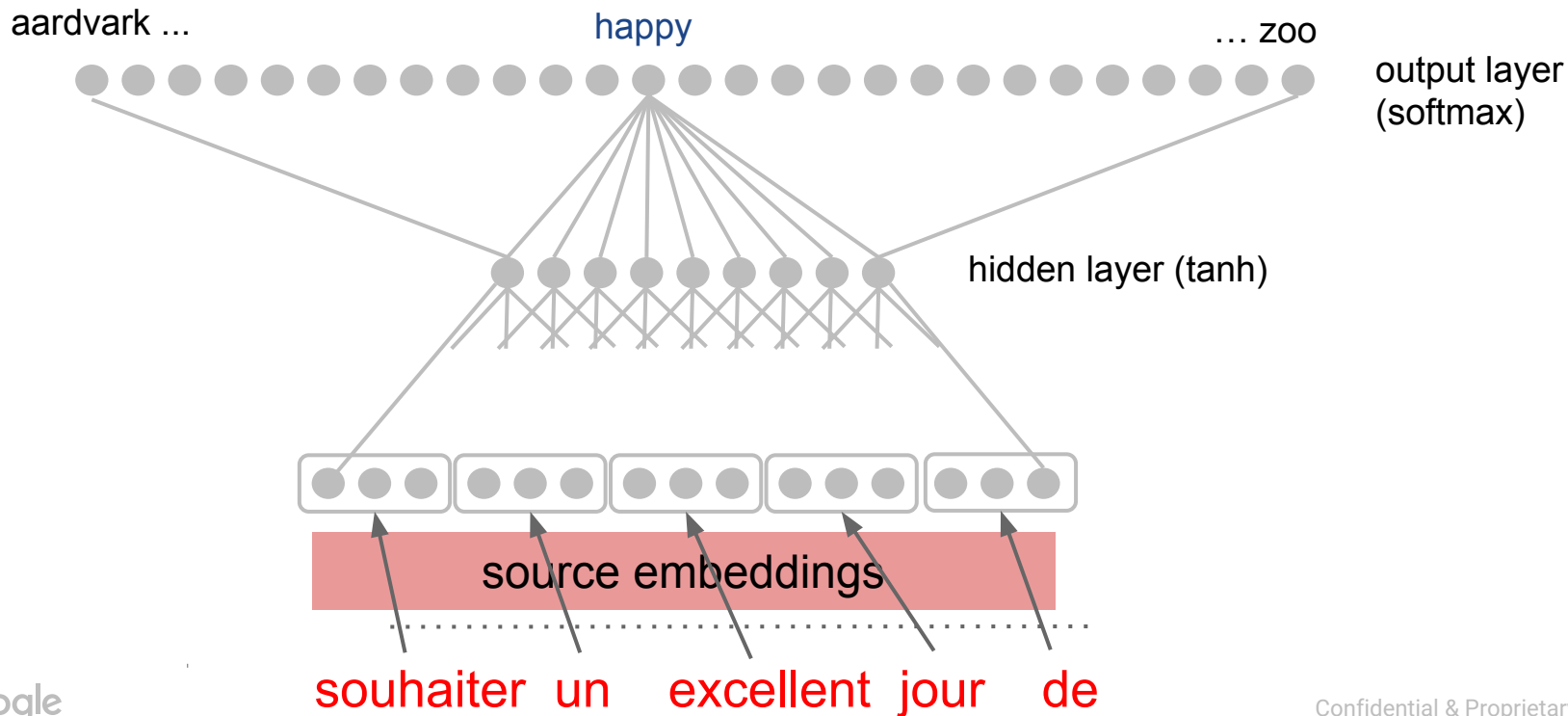
NNJM

$p(\text{happy} \mid \text{wish everyone a souhaiter un excellent jour de})$

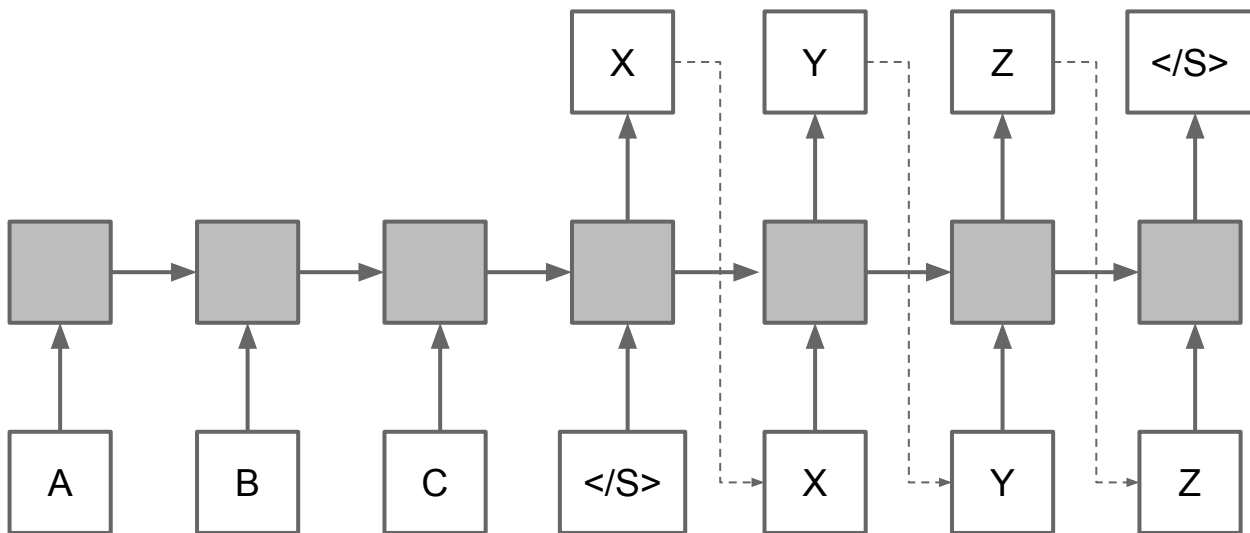


NNLTM

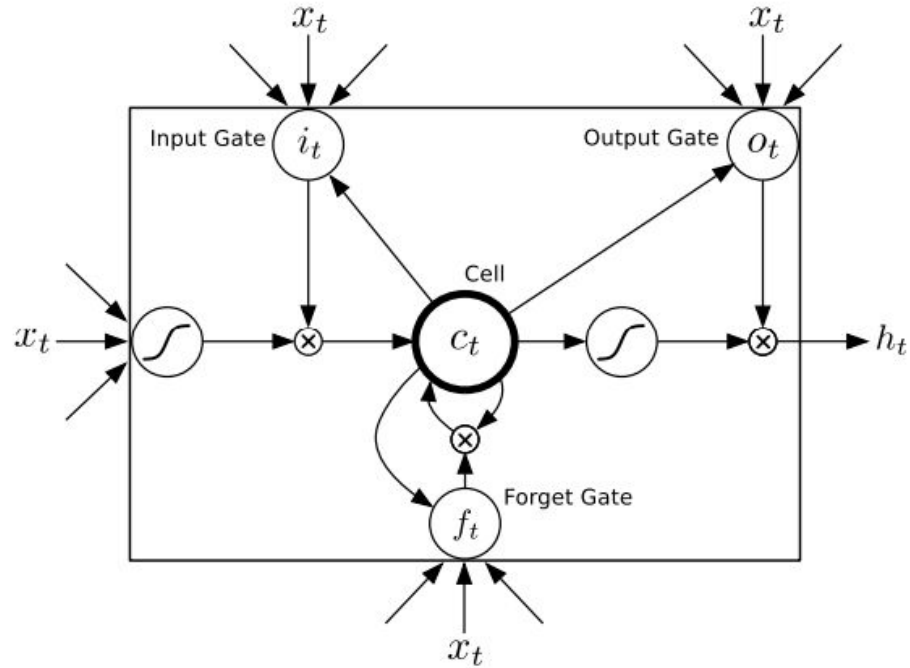
$p(\text{happy} \mid \text{souhaiter un excellent jour de})$



Long Short-Term Memory



A Single LSTM Cell



Model formulation

NNJM: $p(t_i | t_{i-n} \dots t_{i-1}, s_{a_i-m} \dots s_{a_i+m})$

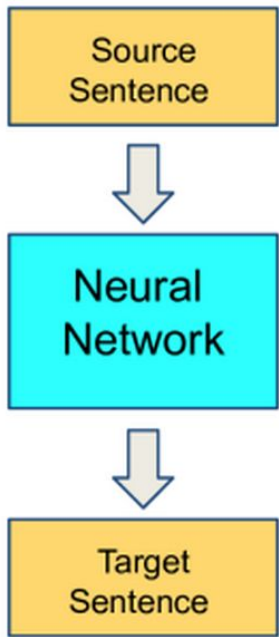
NNLTM: $p(t_i | s_{a_i-m} \dots s_{a_i+m})$ **S:** 我 ³就 ⁴取 ⁵钱 ⁶给 ⁷了 她们
i will get money to perf. them
T: ²i ¹will ⁰get the money to them
P(the | get, will, i, 就, 取, 钱, 给, 了)

([Devlin et al. ACL 2014](#))

LSTM: $p(t_i | t_1 \dots t_{i-1}, s_1 \dots s_L)$

LSTMs can condition on everything; (theoretically) most powerful.

No reliance on a phrase-based system.



([Sutskever et al, NIPS 2014](#))

