Multilinguality

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What is multilinguality

- Used to describe systems that involve more than one language
- Not one clear definition
- At conferences: often used to cover everything involving more than one language, except machine translation

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  - There might be no pre-processing tools for Y
  - You do not feel up to creating all these resources

Use other languages!

- Luckily, languages are related, and can have a lot in common!
- Maybe there is a language similar to Y which has data and resources
- Multilingual NLP: Use data/resources for one (or more) languages, to solve a problem for another language!

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- Luckily, languages are related, and can have a lot in common!
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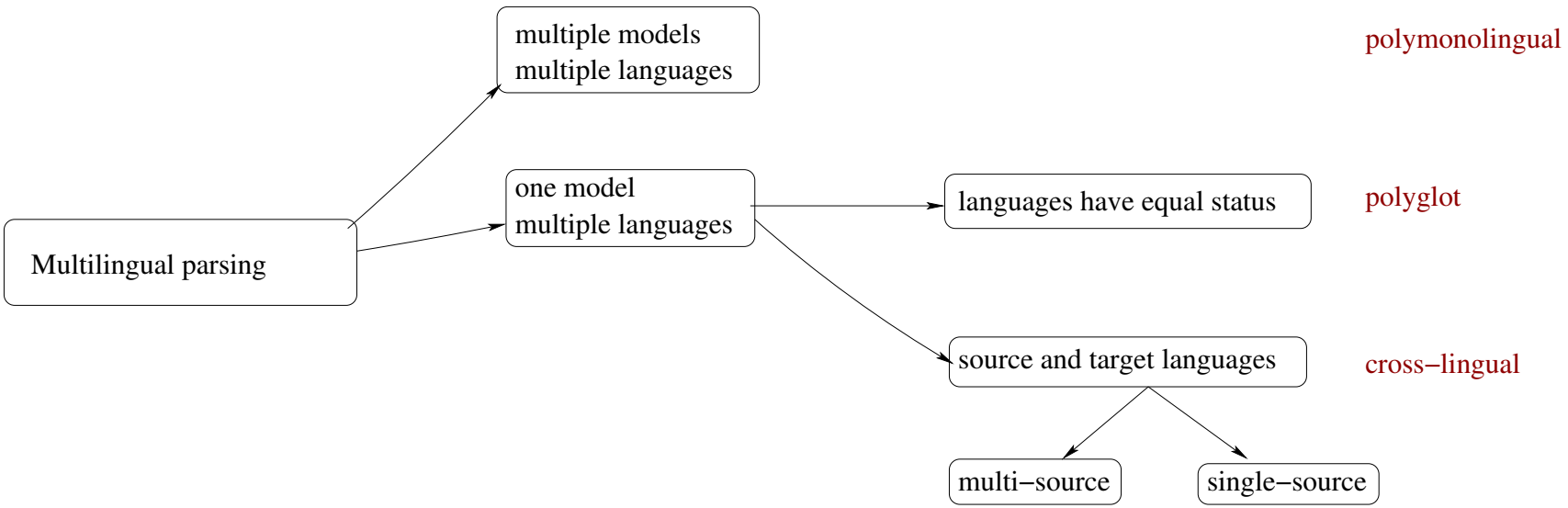
- Multilingual NLP: Use data/resources for one (or more) languages, to solve a problem for another language!
- Often used for low-resource languages
- But can also improve systems for medium/high resource languages

Terminology suggestion for parsing



From Miryam de Lhoneux

Focus in the course

- Polyglot:
  - Models that include several languages with equal status
- Cross-lingual:
  - Models that use one or more source languages and apply to a target language
  - No or little (annotated) data from the target language

Not in focus

- Polymonolingual systems
  - Systems where one architecture is used for many languages, but where an individual model is trained for each language
- Machine translation
  - Except when machine translation systems are trained in a cross-lingual/polyglot manner

Applications

- Multilingual systems can be trained for all type of applications
  - Tagging
  - Parsing
  - Machine translation
  - Lemmatization
  - Language modelling
  - Semantic role labelling
  - ...

Resources used for multilingual systems

- Parallel corpora
- Bilingual lexicons/Tag dictionaries
- Typology, databases like WALS
- Language relatedness
- Target data (possibly tiny, noisy and/or incomplete)
- Cross-lingual word embeddings

Cross-lingual methods

- Annotation projection
- Translation of data
- Delexicalized transfer
- Parameter transfer
- Training guidance/soft constraints
- Joint learning
- ...

Neural cross-lingual systems

- Neural models typically work well with multilingual models
- Multilingual systems can be viewed as multi-task systems
- Possible to share all or parts of an architecture
- Allows language representations as part of models
- Cross-lingual word embeddings an important resource

Example: polyglot dependency parsing

- Work from our parsing group at UU (de Lhoneux, Nivre, Smith, Stymne)
- Neural dependency parser
- Add a treebank embedding to the representation of words
- The rest of the architecture is shared for all languages
- Train polyglot models for groups of mainly related languages

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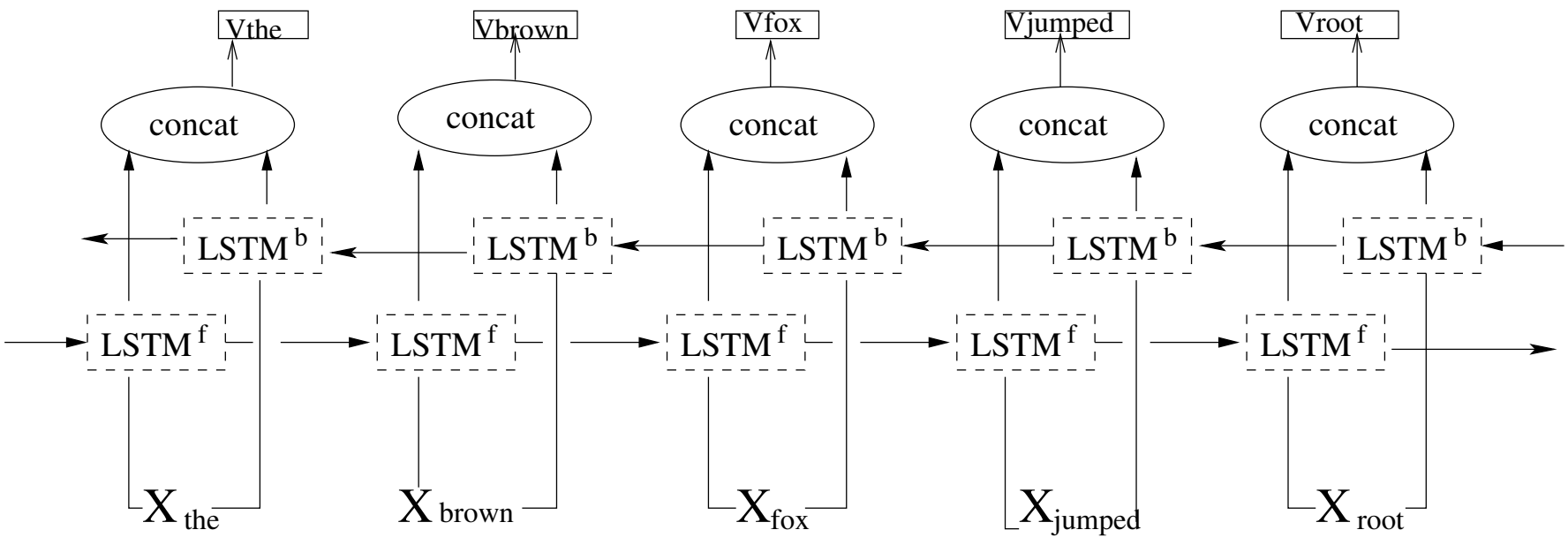
- This method also works monolingually when a language has many (diverse) treebanks

Our BiLSTM-based parser

X_{the} X_{brown} X_{fox} X_{jumped} X_{root}

Our BiLSTM-based parser



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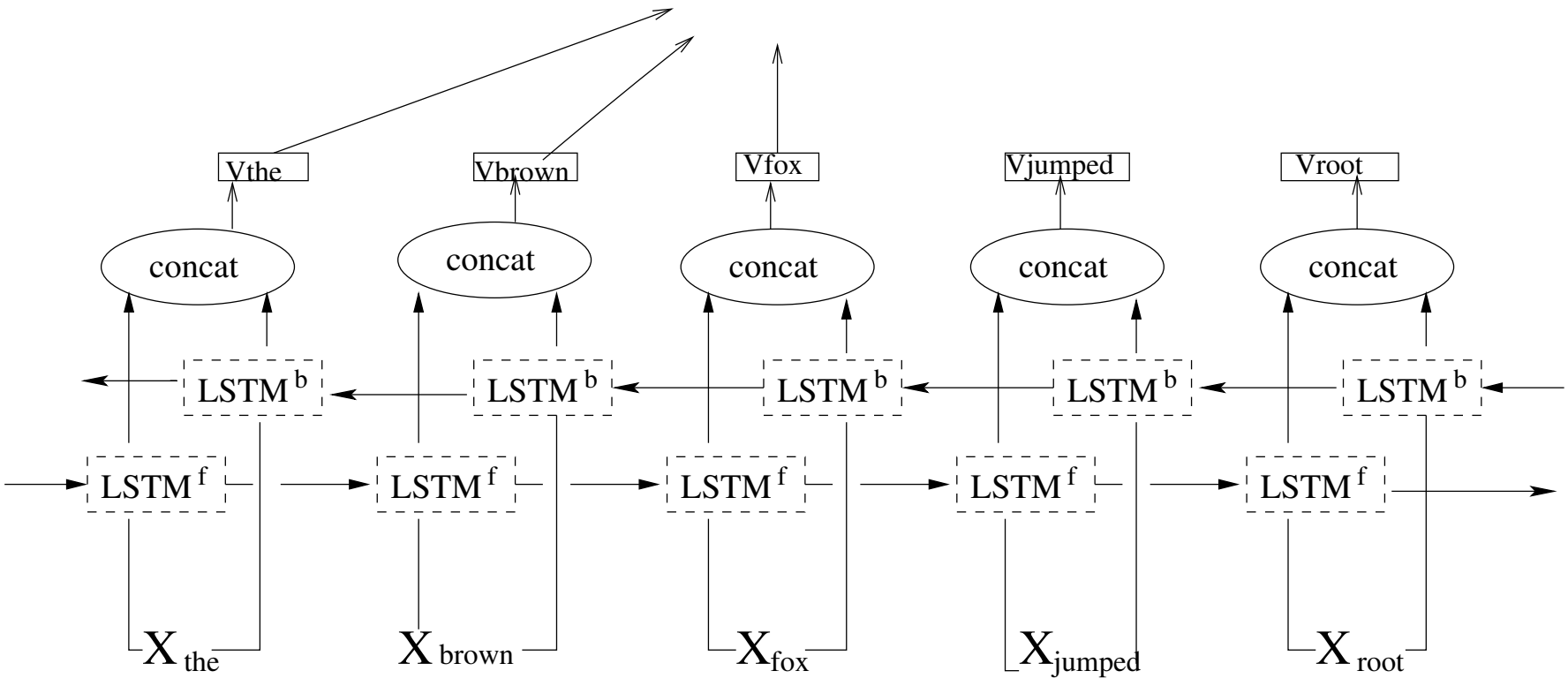

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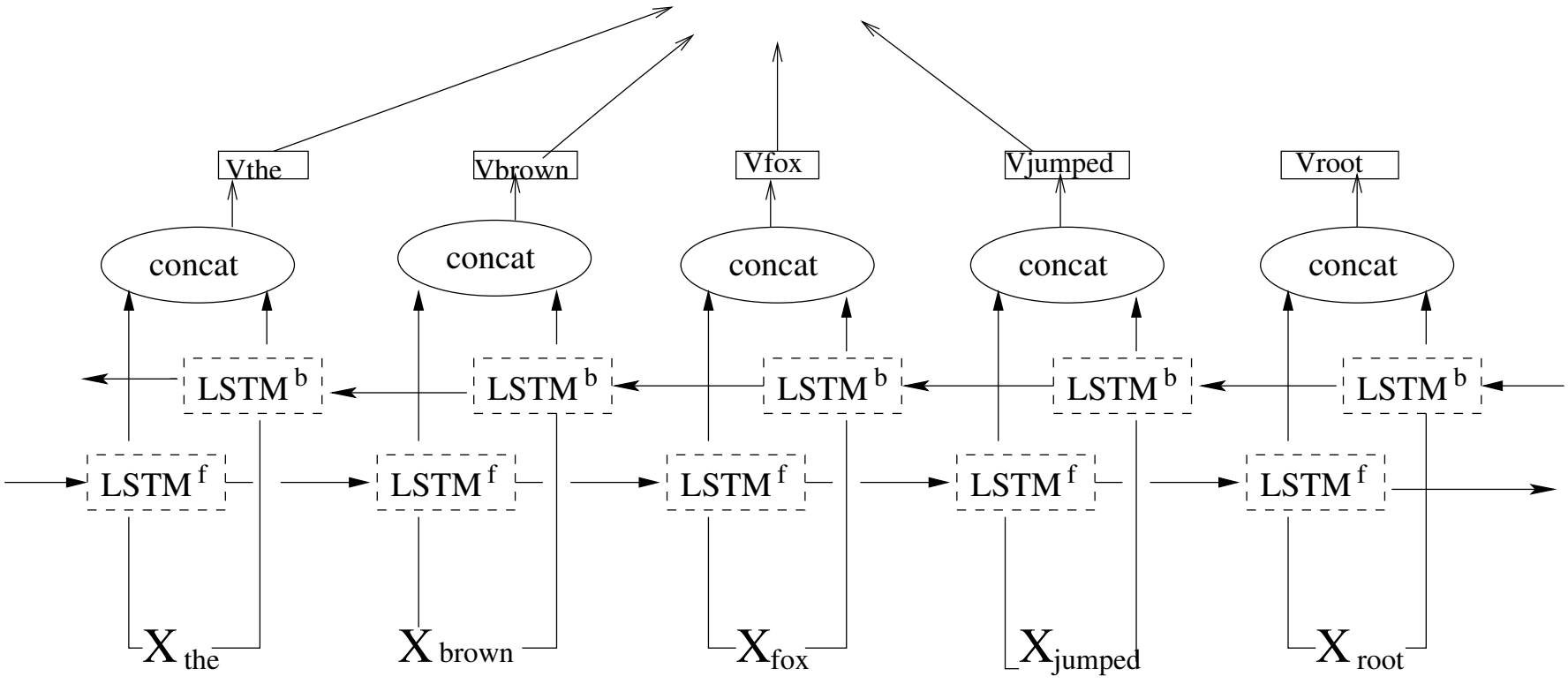

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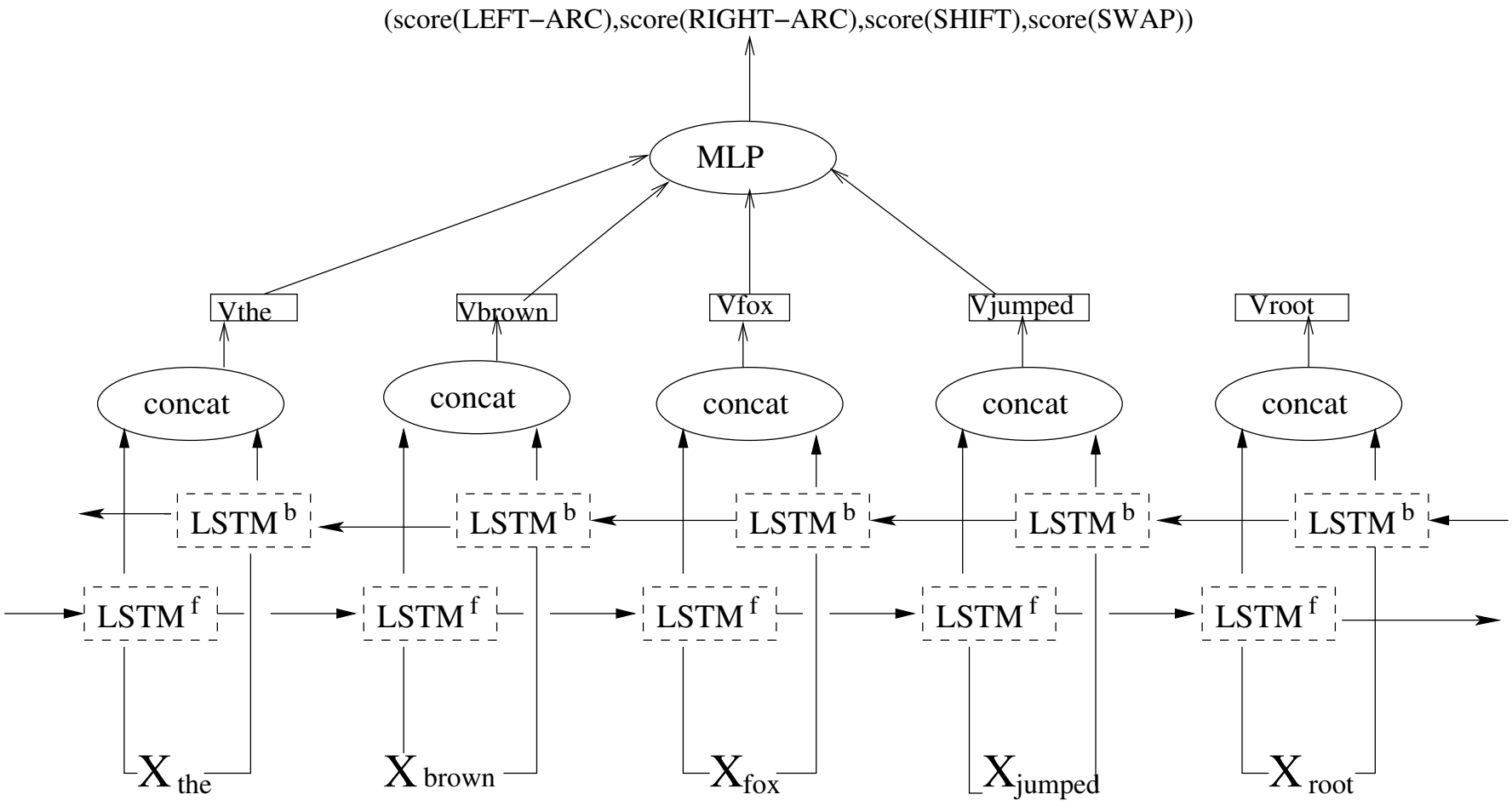
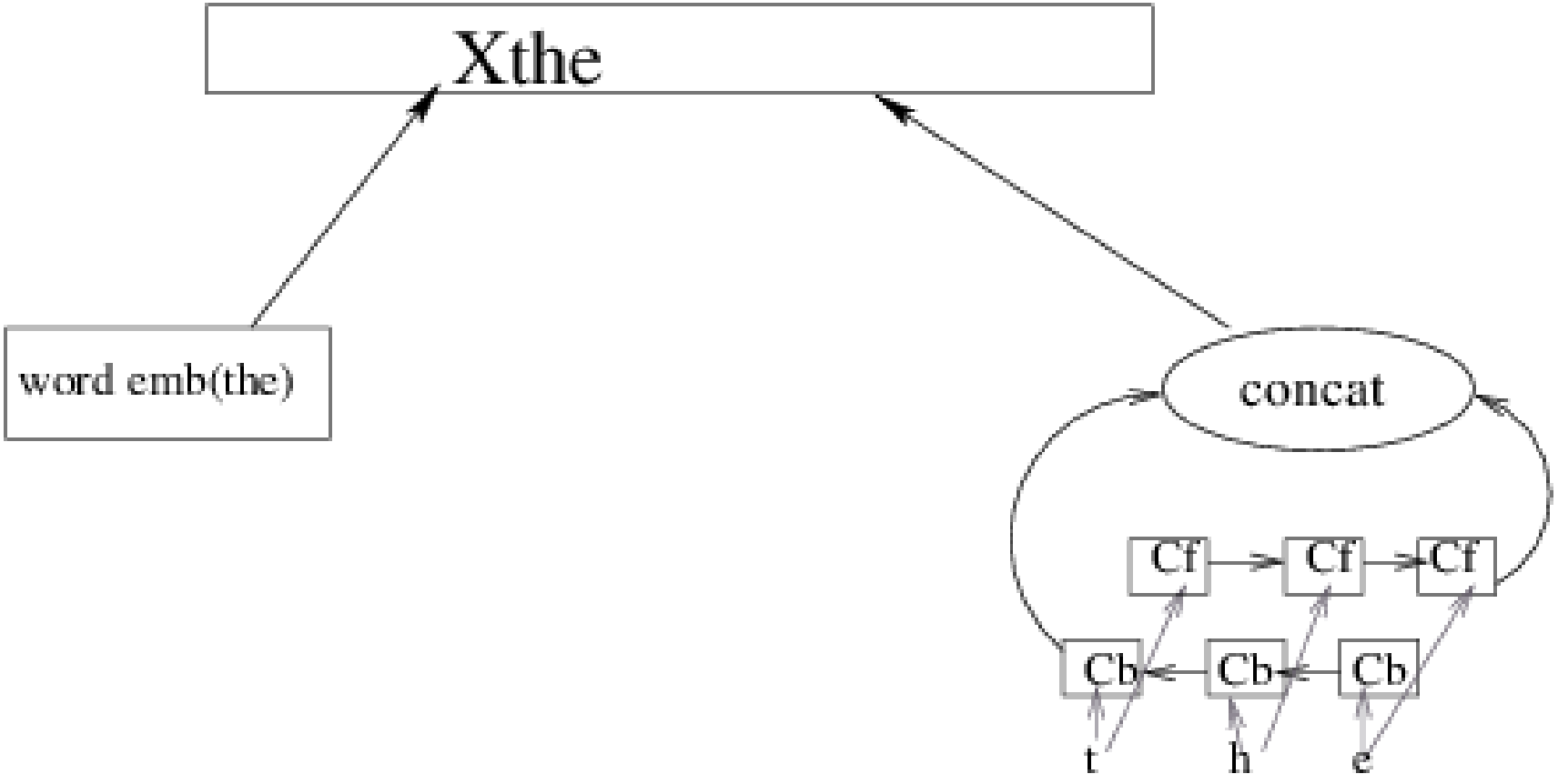
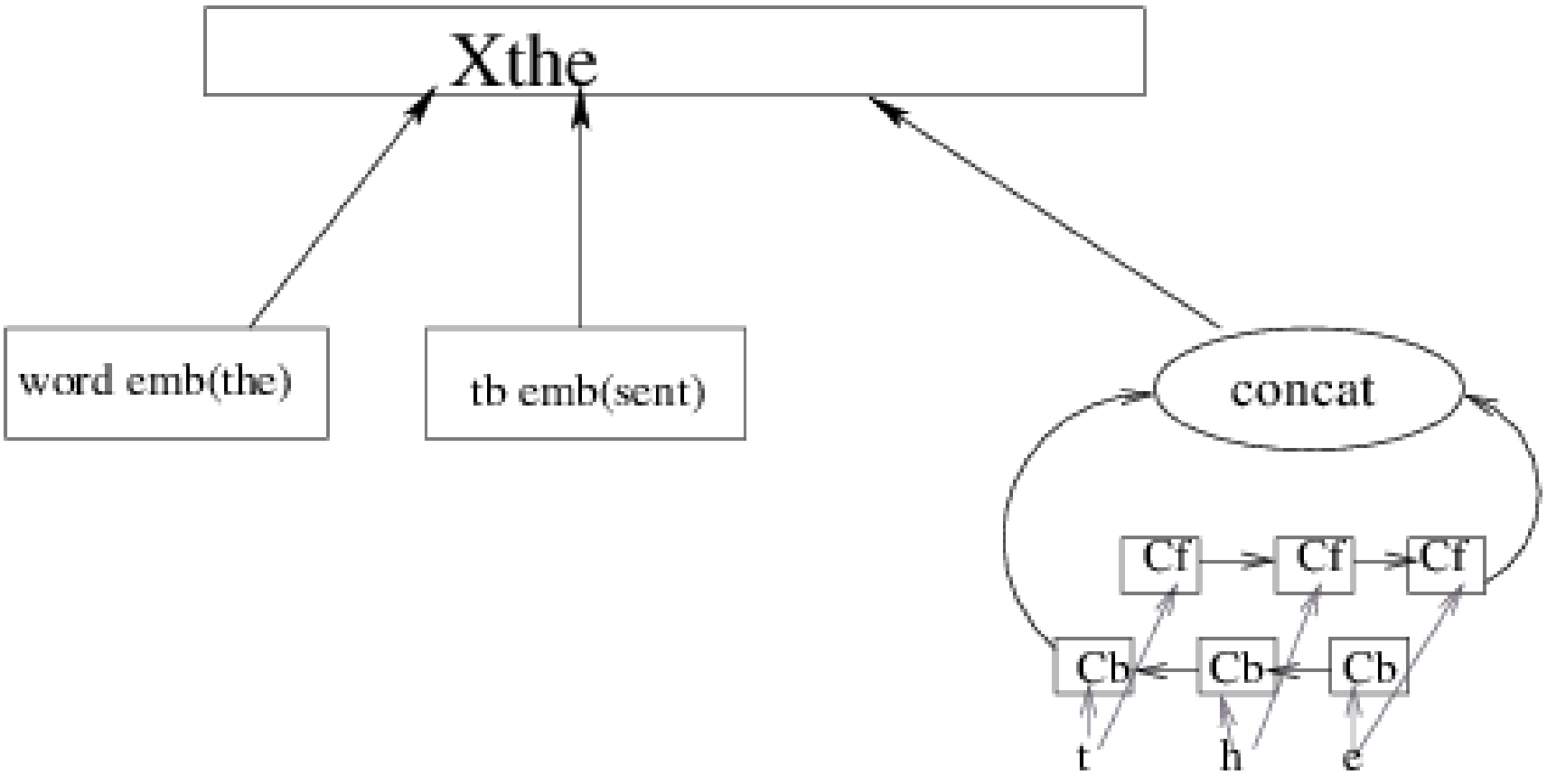


Word representations



Word representations + treebank embeddings



Polyglot parsing: results

- Results at CoNLL 2018 shared task
- Comparison with a monolingual model
- Metric: LAS

Language(s)	Monolingual	Polyglot	Diff
Kazakh	23.9	32.0	+8.1
Swedish	83.3	84.3	+1.0
German	75.2	75.5	+0.3
Low-resource	17.7	25.3	+7.6
All	70.7	72.3	+1.6

Project suggestions

- All projects should involve more than one language
- You can focus on essentially any application

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- All projects should involve more than one language
- You can focus on essentially any application
- Some possibilities (CLP = cross-lingual/polyglot)
  - Come up with a new CLP method or an extension of an exisiting CLP method for a specific task
  - Extend CLP work to a new application
  - Perform an in-depth evaluation study of some CLP method
  - Compare different CLP methods or resources
  - Explore which languages to choose and/or how to mix languages for a/several target language(s)
  - Address issues with inconsistent tag sets/annotations across languages
  - ...

Papers

Aaron Smith, Bernd Bohnet, Miryam de Lhoneux, Joakim Nivre, Yan Shao, and Sara Stymne. (2018) *82 Treebanks, 34 Models: Universal Dependency Parsing with Multi-Treebank Model*. CoNLL.

Jörg Tiedemann. (2015) *Cross-Lingual Dependency Parsing with Universal Dependencies and Predicted PoS Labels*. DepLing.

David Yarowsky, Grace Ngai, and Richard Wicentowski. (2001) *Inducing multilingual text analysis tools via robust projection across aligned corpora*. HLT.

Goran Glavaš, Robert Litschko, Sebastian Ruder, and Ivan Vulić. (2019) *How to (Properly) Evaluate Cross-Lingual Word Embeddings: On Strong Baselines, Comparative Analyses, and Some Misconceptions* ACL

Robert Östling and Jörg Tiedemann. (2017) *Continuous multilinguality with language vectors*. EACL.

Barbara Plank and Željko Agić. (2018) *Distant Supervision from Disparate Sources for Low-Resource Part-of-Speech Tagging*. EMNLP

Yu-Hsiang Lin et al. (2019) *Choosing Transfer Languages for Cross-Lingual Learning*. ACL.

Jörg Tiedemann. (2012) *Character-Based Pivot Translation for Under-Resourced Languages and Domains*. EACL.

Barret Zoph, Deniz Yuret, Jonathan May, and Kevin Knight. (2016) *Transfer Learning for Low-Resource Neural Machine Translation*. EMNLP.

Questions?