
SYSTRAN Software
Intelligent Language Technologies
Building Renewable
Language Assets in
Government Domains

Agenda

- Why SYSTRAN
- Background of Government Work
- Current Direction

Why SYSTRAN

Expertise

- Leadership role for 40+ years in machine translation
- 200+ language technology professionals in the US, France and Korea

Best Fit Technology

- Multiple deployment options (on-premise, desktop, mobile, cloud)
- Specialized engines for domains

Continuous Improvement

- Re-investment of 25% revenue into R&D
- Partnerships with academia, currently focused in the area of Neural MT

Trusted Industry Partner

- Organic growth through government partner referrals
- Flexible approach to meet mission requirements

Background of Government Work

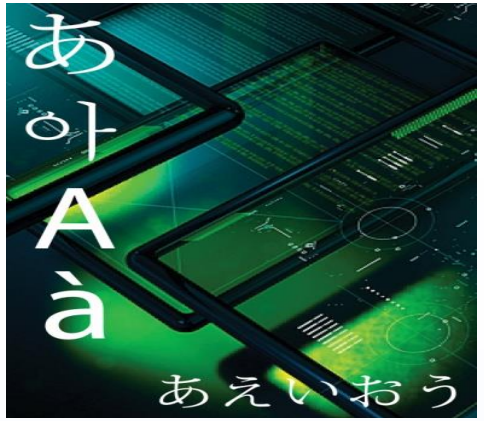
IT Systems

- IC Networks
- Command, Control, Communication, Computers & Intelligence (C4I) Systems

Language expansion resulting from world events, starting with Russian

Language Requirements

Technology Evolution



1. Migration off the mainframe
2. Arrival of the internet
3. Statistical MT
4. **Neural MT**

What have we done in the past

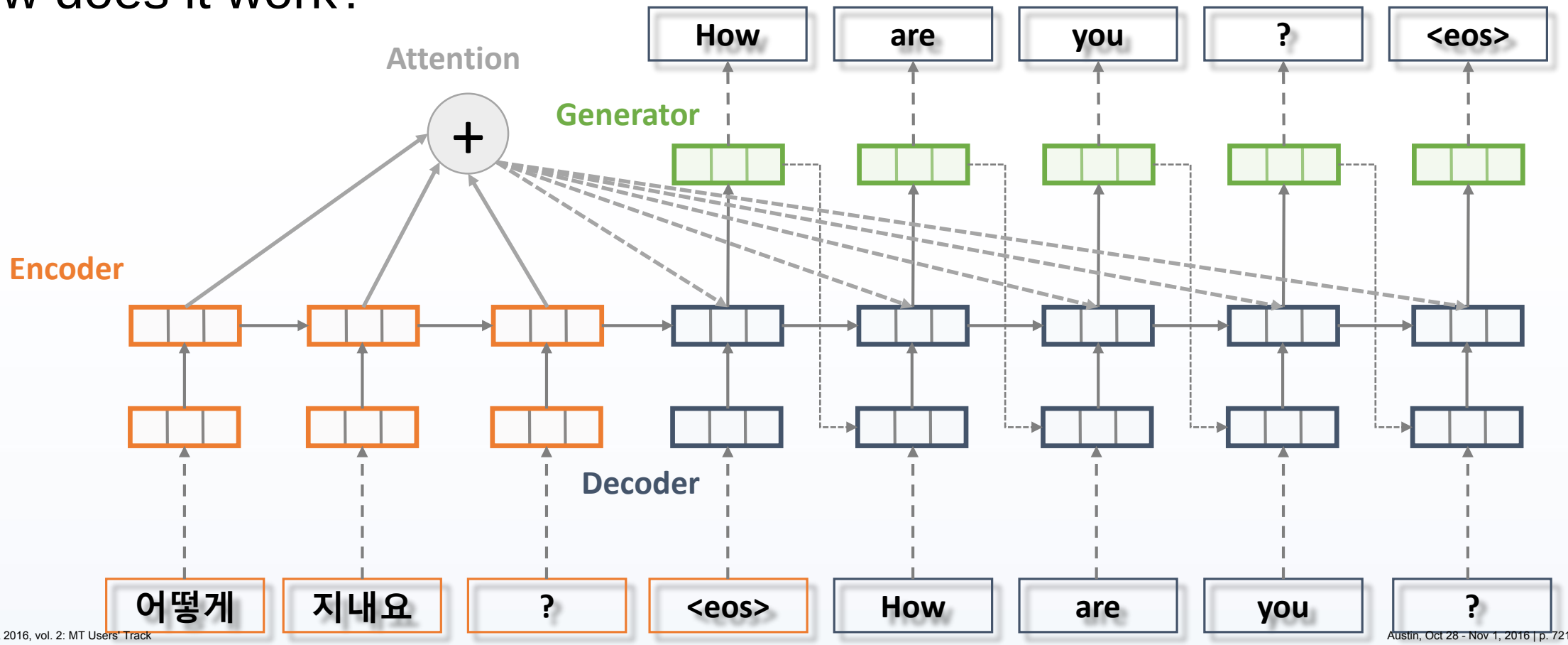
- Full Rule-Based Backbone for English target
  - Morphology, part of speech, normalization
  - Mix rules and statistical decision models
- Statistical post-editing (SPE)
  - Statistical layer to fine tune output based on bilingual corpus
  - Allows for greater customization
  - Allows for quality translations in domains with little bilingual corpus
- Dictionaries
  - Extensive dictionaries – user defined
  - Cover terminology not found in bilingual corpus
  - Cover low resource domains and languages – Science and Technology
- Entity recognition

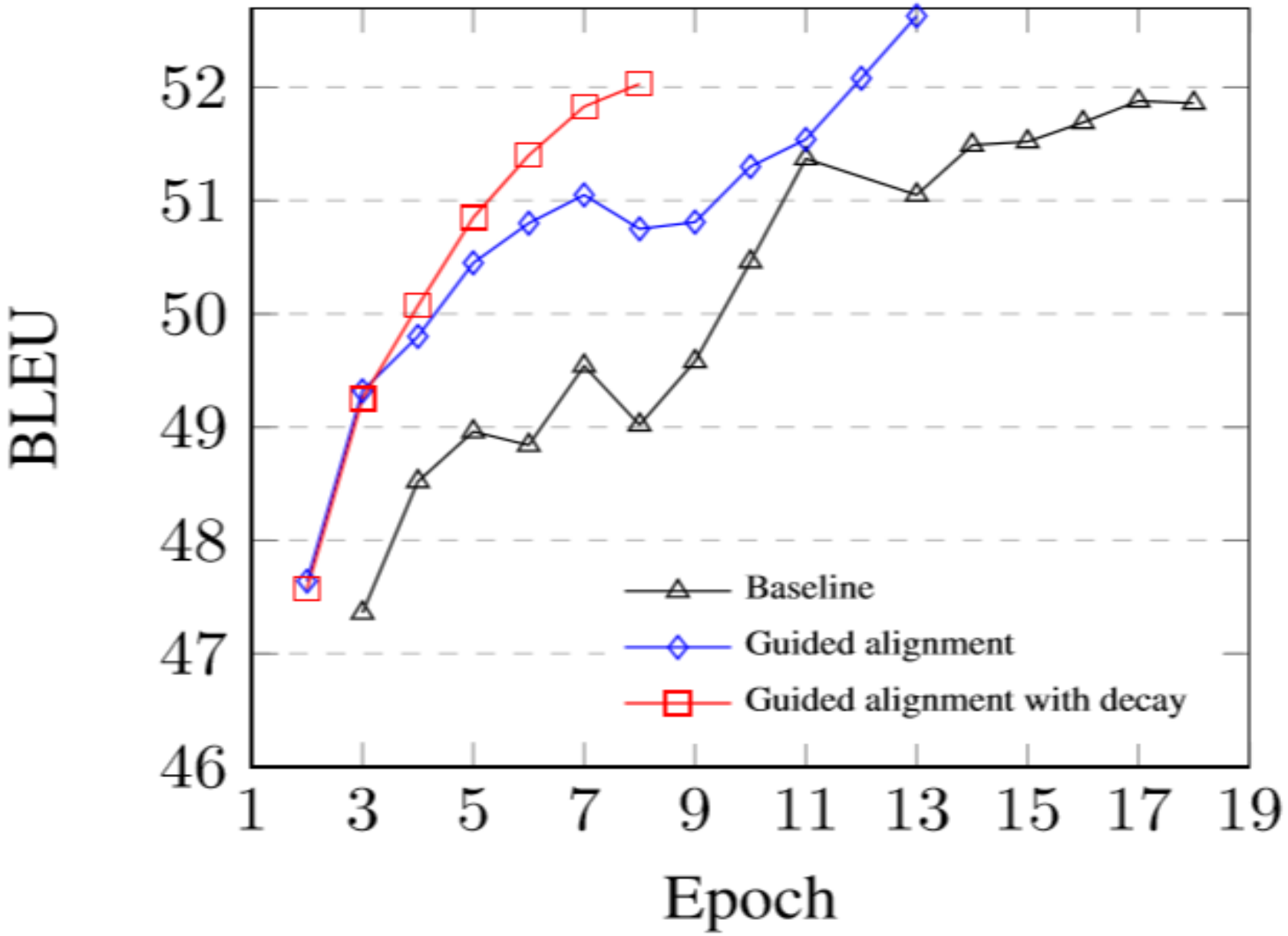
Pure Neural Machine Translation

- http://demo-pnmt.systran.net
  - 14 language pairs with more on the way
- https://arxiv.org/pdf/1610.05540v1.pdf
- Systran specialization
  - Architecture
  - Pre-processing
  - Features
  - Post-processing
  - Domain specialization
- Incorporate standard customization features
  - User Dictionaries, Translation Memory etc.

Neural Machine Translation

- How does it work?




BLEU
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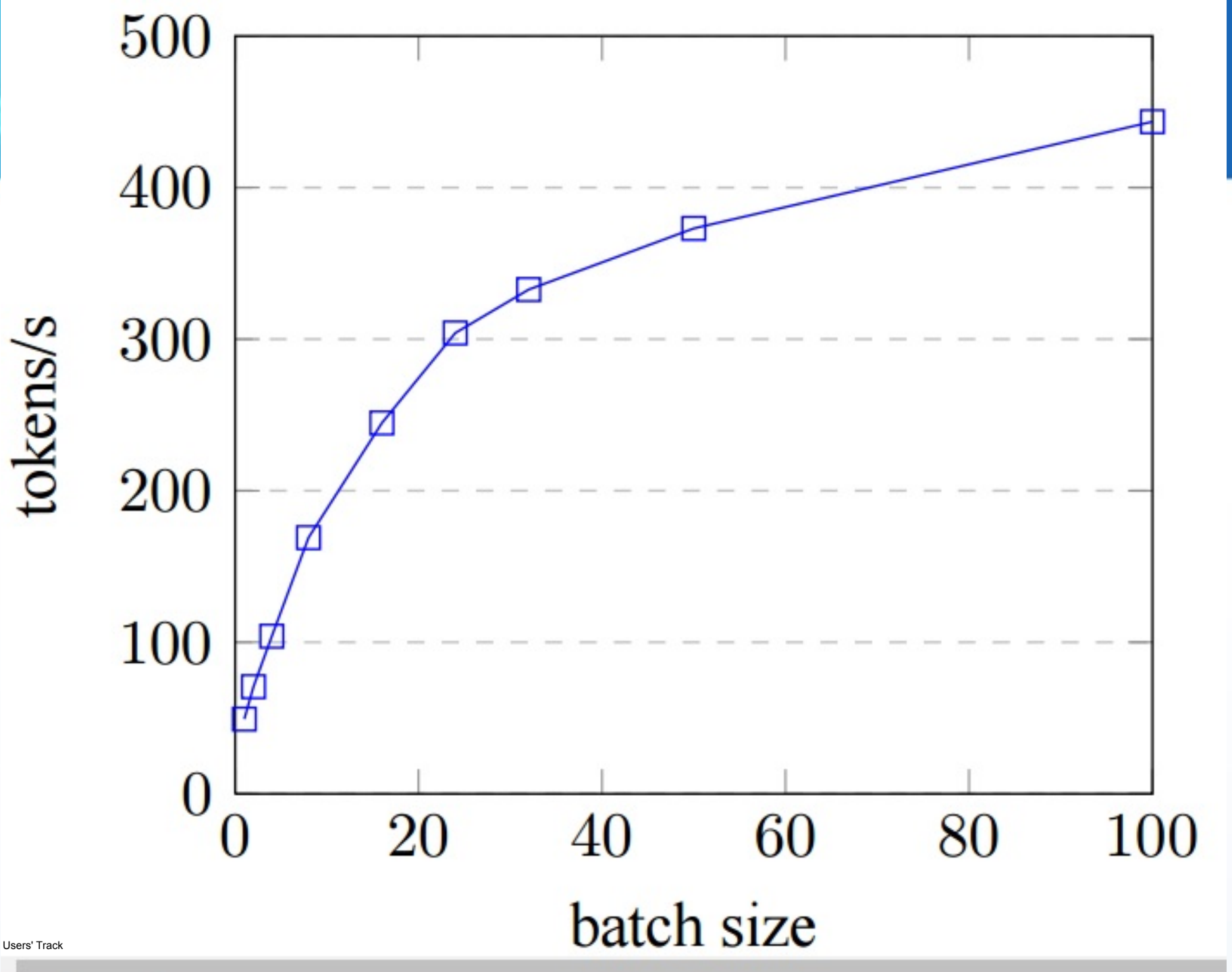
Epoch
Baseline
Guided alignment
Guided alignment with decay

Architecture

- seq2seq-attn (https://github.com/harvardnlp/seq2seq-attn)
  - Harvard NLP group
  - Sequence to sequence RNN
  - Guided attention with decay
  - Features in source and target
  - Open source with ability to tune several parameters
- Run time can now be done on CPU
  - 4 threads on a desktop Intel i7 CPU
  - Pruning
  - Distillation
  - Batch modes with beam size


500
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tokens/s
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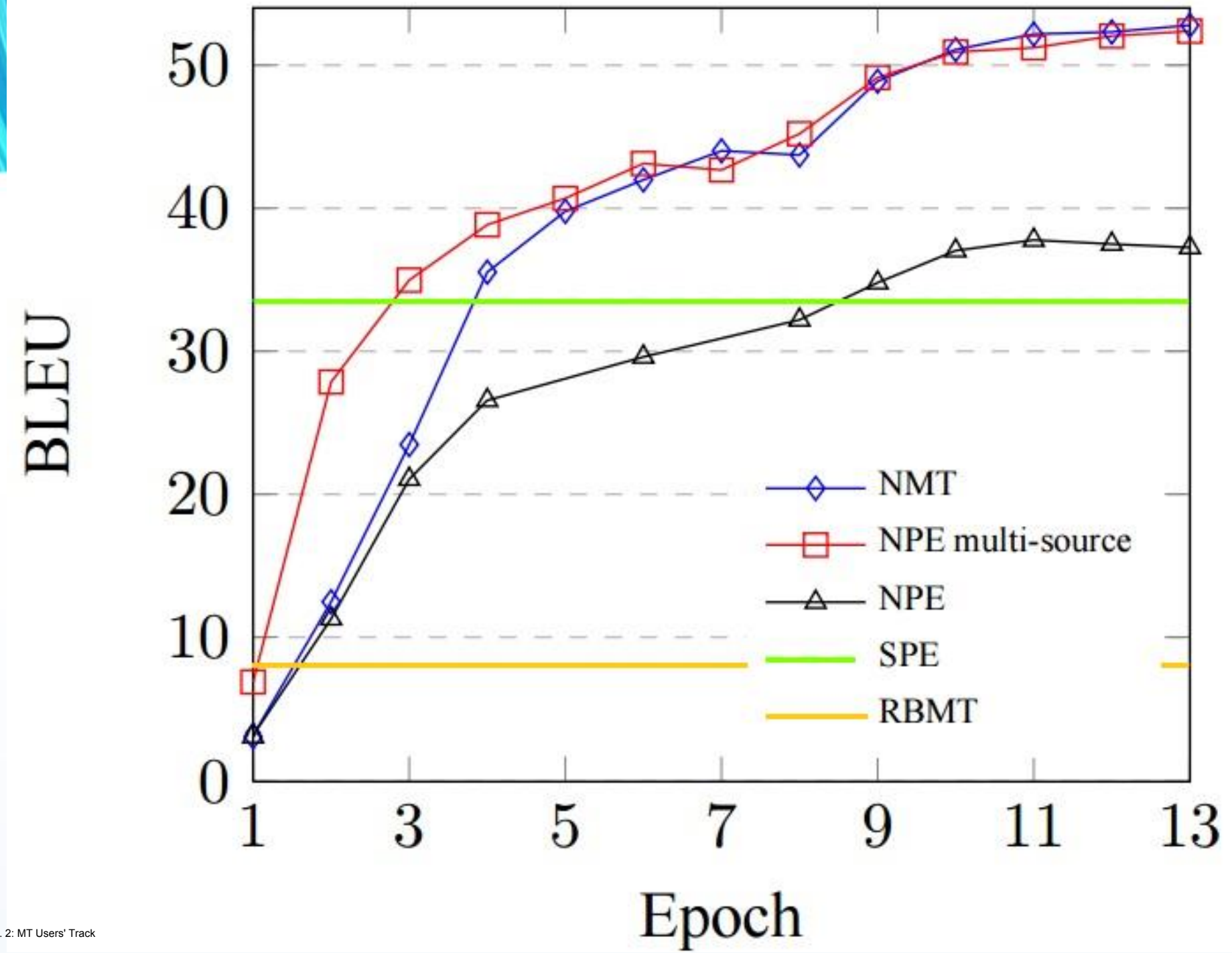
batch size

Pre-processing

- Normalization
- Tokenization
  - Word based
  - Special tokenization for CJK, German and Arabic
  - More experimentation (BPE, character, combo)
- Entity recognition – replace with token (__ent_numeric)
  - Replacement needs to be in both to learn

Linguistic Features

- Dictionaries, entities, capitalization
  - Maybe include part of speech, parse
- Formality mode – Korean
  - Domain mode
- Include traditional translation
  - Smart "Neural Post-Editing"
- Can't neural networks learn everything, given enough data?
  - Depends on complexity of language and amount of data
  - We know NMT has issues with OOV


BLEU
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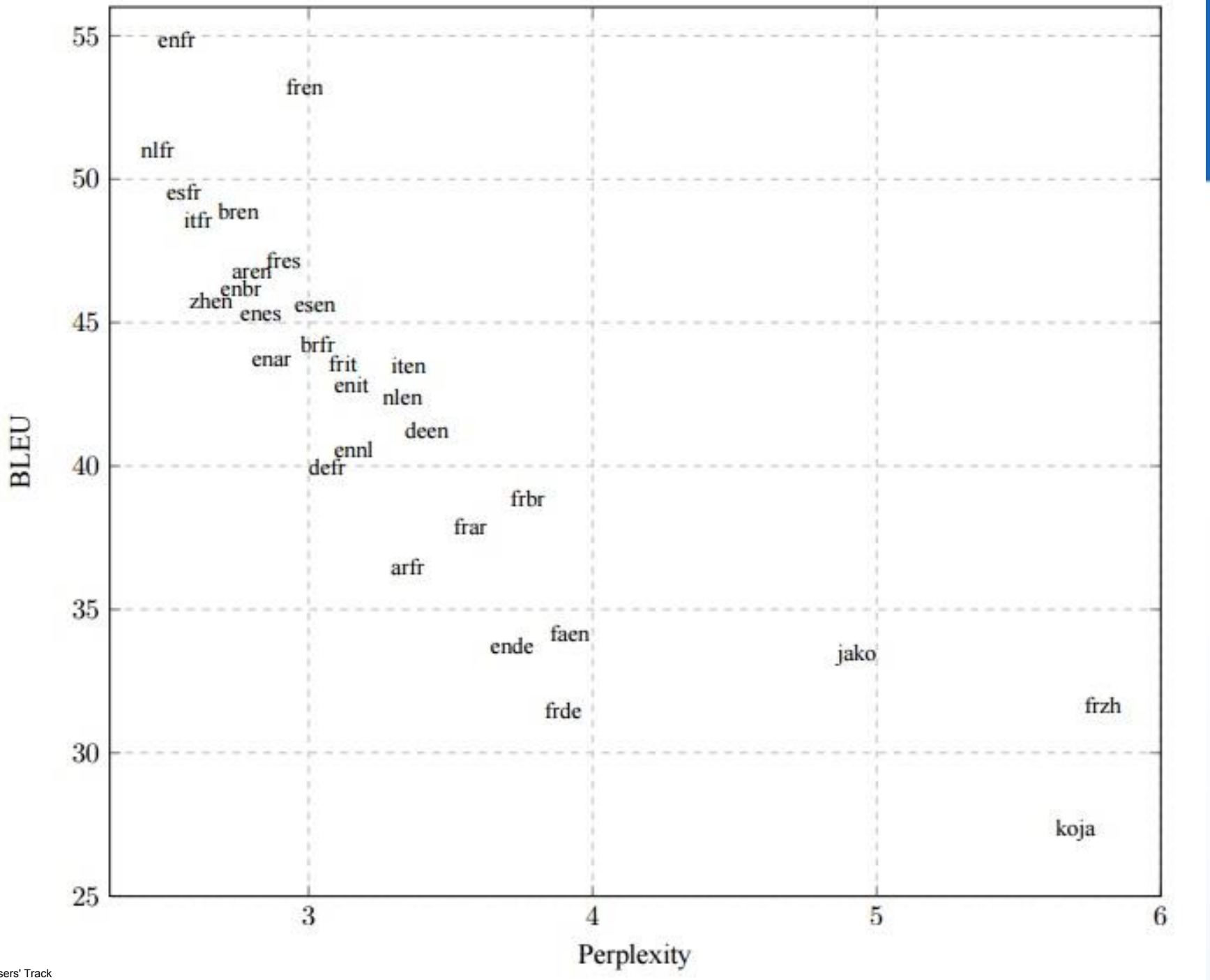
Epoch
NMT
NPE multi-source
NPE
SPE
RBMT

Post-processing

- Restore entities and dictionary terminology
- Apply features (capitalization)
- Restore punctuation
- Out of Vocabulary
  - Look them up with dictionary
  - Use SMT-style phrase table
  - Allow NMT to transliterate

Domain specialization

- Stack neural networks
  - Adds another neural network trained on in-domain corpus
  - Requires some tweaks on vocabulary
  - Enable full specialization in a few hours
- Marker for domain
- Synthetic corpus
  - Makes use of well-written, in-domain sentences from target language
- Inject terminology
  - Full support for User Dictionaries
  - Explicit recognition of entities
  - Other linguistic knowledge?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Perplexity
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frzh
koja

Examples

- FARSI: فرهنگ هر کشور دارای هویت و ویژگی های خاص خود می باشد.
- SPE: Culture of each country has identity and its special features.
- PNMT: The culture of each country has its own identities and particularities.

- FARSI: به دلیل اختلافات ایدئولوژیکی و عدم توافق بر سر اهداف مورد حمله, بسیاری از هسته ها از این سازمان تازه بیرون کشیدند یا هیچوقت به آن نپیوستند.
- SPE: For an ideological reason for disagreements and discordance, goals of case of attack pulled out many of nuclei of this new organization over or they never joined that.
- PNMT: Many cells pulled out of the new organization or never joined it because of ideological differences and disagreements over the targeted targets.

QUESTIONS

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