

SIGTYP 2020 Shared Task

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📅 September 24, 2020



EUROPEAN UNION
European Structural and Investment Fund
Operational Programme Research,
Development and Education

Charles University
Faculty of Mathematics and Physics
Institute of Formal and Applied Linguistics

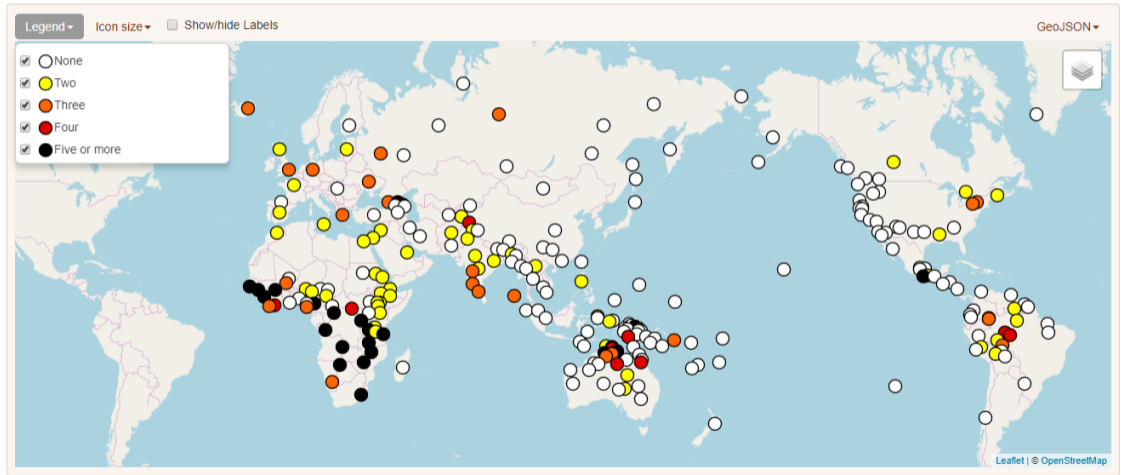


unless otherwise stated

ACL Special Interest Group on Typology
<https://sigtyp.github.io/>
(founded 2020)



Number of Genders



- Lexical category of nouns
- Agreement or cross-reference elsewhere:
 - Pronouns
 - Adjectives, determiners (inflection)
 - Verbs (inflection)
 - ... or a subset thereof
- Data:
 - Ukrainian and Russian: 3 genders (not 4, with animacy)
 - Czech and Slovak not shown at all
 - English: 3 genders; although only in pronouns!

192 WALS Features

- 1A Consonant Inventories
- 2A Vowel Quality Inventories
- ...
- 20A Fusion of Selected Inflectional Formatives
- 26A Prefixing vs. Suffixing in Inflectional Morphology
- 27A Reduplication
- 28A Case Syncretism
- ...
- 81A Order of Subject Object and Verb
- 85A Order of Adposition and Noun Phrase
- 107A Passive Constructions
- 120A Zero Copula for Predicate Nominals
- ...
- 129A Hand and Arm
- 131A Numeral Bases
- 138A Tea

7 General (Non-linguistic) Features

- WALSL language code: *cze*
- Language name: *Czech*
- Family: *Indo-European*
- Genus: *Slavic*
- Latitude: *50.0*
- Longitude: *15.0* ... somewhere east of Kouřim :-)
- Country codes: *CZ*

Sparse Data

- 2662 languages in WALS (only 1357 used in the shared task)
- 7 general features
- 192 linguistic features (only 185 in the shared task)

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- **Features per language**
 - maximum (English): 159 linguistic features
 - median: 28 linguistic features
 - minimum (2 languages): 4 linguistic features

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- **Languages per feature**
 - maximum (87A Order of Object and Verb): 785 languages
 - median: 168 languages
 - minimum (2 features): 8 languages

The Shared Task

- How well could the missing feature values be guessed?
- 1125 training languages
- 83 development languages
- 149 test languages
- Some features (about 50% randomly picked) are **masked**: the value is **?**
- Task: based on the remaining features in this or other languages, **predict the values of the masked features**

The ÚFAL Submission

- Probabilistic System
- Neural System
- Combined System

- + a number of other dead-end attempts

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 - 81A Order of Subject, Object and Verb
 - = 3 VSO
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 - = 2 Noun-Adjective
 - In training data (**given that 81A = 3 VSO**):
 - 54 languages have both features filled
 - 28 languages (**52%**) = **2 Noun-Adjective**
 - 19 languages (35%) = 1 Adjective-Noun
 - 7 languages (13%) = 3 No dominant order

Greenberg Universals

- Greenberg (1963): there are **correlations**
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- WALS features:
 - 81A Order of Subject, Object and Verb
 - = 3 VSO
 - 87A Order of Adjective and Noun
 - = 2 Noun-Adjective
 - In training data (**regardless of 81A**):
 - 713 languages have 87A filled
 - 455 languages (**64%**) = **2 Noun-Adjective**
 - 200 languages (28%) = 1 Adjective-Noun
 - 53 languages (7%) = 3 No dominant order
 - 5 languages (1%) = 4 Only internally-headed relative clauses

$$\begin{aligned} \text{score}(s_i = x, t_j = y) &= P(t_j = y | s_i = x) \\ &\times \log c(s_i = x, t_j = y) \\ &\times I(s_i, t_j) \end{aligned} \tag{1}$$

- Single best signal (no voting among source features)
- Country codes: ignore *US*
- Latitude and longitude: group into zones

- **Language embeddings** based on their feature values
- Latitude and longitude: cluster the points via k-Means, use cluster id as feature
- Training neural network:
 - Pick language
 - Pick feature value (50% probability that it belongs to the language)
 - Goal of the network: predict that a feature value belongs to the language
- Prediction
 - For a language and a masked feature:
 - Pass all possible values to the network
 - Pick the value with the highest output probability

- Development data:
 - Neural system is slightly better (74.49% > 73.81%)
 - The systems make different errors (oracle → 81%)
- System-internal confidence scores:
 - Probabilistic system → cond. prob. × log count × mutual info
 - Neural system → output feature prob. from the network
- Empirically found thresholds T_N and T_P
 - If neural confidence > T_N , use neural system
 - Else: if probabilistic confidence > T_P , use probabilistic system
 - Else use again neural system

System	Dev	Test
Baseline	53.45	51.39
Probabilistic	73.81	71.08
Neural	74.49	69.80
Combined	75.50	70.75
Feed-forward	56.45	
kNN-Hamming	62.28	
kNN-LangEmbed	68.10	

Table 1: Accuracy of various models on the development and test data.

SIGTYP Shared Task 2020 Rankings

Task: Constrained

1. ÚFAL

2. NEMO_system2

3. NEMO_system1

4. Panlingua_rule

5. Panlingua_hybrid

6. Panlingua

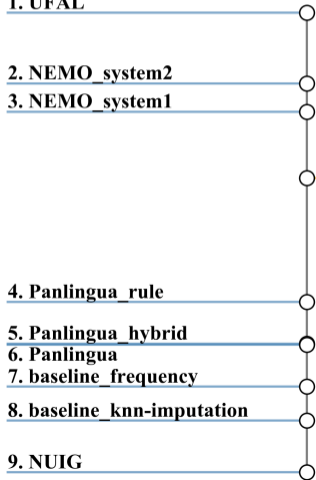
7. baseline_frequency

8. baseline_knn-imputation

9. NUIG

Task: Unconstrained

1. CrossLingference



Thanks!
Díky!