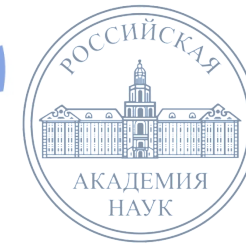


Kyrgyz NLP: Challenges, Progress, and Future

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Bishkek, 2024



Let us introduce ourselves



Anton Alekseev

PDMI RAS, SPbU, KFU, KSTU

Research, consulting & teaching

PhD student at KSTU n . a. I. Razzakov

9y NLP experience in industry & academia

Best NLP Paper @ AIST-2023

2 Kyrgyz datasets in 2023, more to appear



Timur Turatali

The Cramer Project

MLE and Data Scientist with over 8y of experience in industry and startups

Founder of AI community of Kyrgyzstan

Co-founder an open-source initiative called

AkyIAI and The Cramer Project.

What to Expect from This Talk

1. **Data annotation advocacy** – even in the age of LLMs
2. An **overview** of modern Kyrgyz language processing
(scientometrics, recent works, our contributions, other initiatives)
3. **Current performance** of the LLMs on a Kyrgyz benchmark (work in progress)
4. Our proposal of a roadmap for Kyrgyz NLP development

Disclaimers

- many works cite much earlier books, e.g. (Sadykov, 1987), yet we have decided to mostly focus on **works no earlier than 2011**: finding and highlighting machine-readable resources mattered the most
- we realize that there is a large body of **relevant research on other Turkic languages and on Turkic languages' common features**; yet it is almost impossible to cover everything in one talk



31 Oct 1949 – 10 Nov 2023

Last year, Kyrgyz linguistics has suffered a great loss with the passing of **Dr. Tashpolot Sadykov**, a distinguished Turkologist and computational linguist, who passed away in November 2023

Dr. Sadykov's remarkable contributions and pioneering works have left an enduring legacy. In two weeks time, he would have turned 75, and his absence is deeply felt

Outline

1. **Introduction:** LLMs Turning All the Tables
2. **Kyrgyz Language:** What, Why, and How
3. **Kyrgyz NLP Resources:** Diving Ourselves
4. **How LLMs Perform:** Bonus Slide
5. **Community Efforts:** El Pueblo Unido
6. **Roadmap for Kyrgyz NLP:** Humble Proposal
7. **Conclusion:** Don't Say Goodbye

Introduction

LLMs Turning ~~All~~ Some of the Tables

Shakeup in NLPProc [1/2]

Sometimes a meme is worth a thousand words about the 'New AI Spring' and all the talk of the sort

It is obvious that Generative AI and LLMs in general are already transforming education, job market, etc.

- To some, NLP seemed *an obscure field* a few tens of years ago...
- ...now the texts in natural language serve as a medium between humans and 'AI', no one wants to be left out, and everyone is pumped (for a good reason, indeed)

ATTENTION
IS
ALL YOU NEED

2017

PRE-TRAINING OF
DEEP BIDIRECTIONAL
TRANSFORMERS FOR
LANGUAGE UNDERSTANDING

2018

LANGUAGE
MODELS ARE
FEW-SHOT LEARNERS

2020

INTRODUCING
CHATGPT

2022



Shakeup in NLPProc [2/2]

NLP has changed: many high-resource languages enjoy a dramatic increase in quality on most common tasks thanks to the LLMs

Less-Resourced Languages (LRLs)... not so much

- insufficient **volume** of training data
- insufficient **quality** of training data
- **underdeveloped** preprocessing **instruments** and other **resources** affect the overall data quality

The demand for automatic text processing for the LRLs such as Kyrgyz (millions of speakers) only grows

ATTENTION
IS
ALL YOU NEED

Transformers

PRE-TRAINING OF
DEEP BIDIRECTIONAL
TRANSFORMERS FOR
LANGUAGE UNDERSTANDING

BERT & Co

LANGUAGE
MODELS ARE
FEW-SHOT LEARNERS

GPT-3

INTRODUCING
CHATGPT

oh no



Less-Resourced Languages Processing Methods

1. Data Collection and Augmentation
2. Leveraging Machine Translation and Multilingual Models
3. Sampling and Transfer Learning
4. Manual and Unsupervised Tricks
5. Utilizing External Tools (Apertium and Rule-Based MT)

Importance of Data in NLP

Carefully curated data is the **backbone of NLP**, its evolution has continuously been redefining the field, e. g.

- **Penn Treebank (1990s)**

Marcus, M., Santorini, B., & Marcinkiewicz, M. A. (1993). Building a large annotated corpus of English: The Penn Treebank. *Computational linguistics*, 19(2), 313-330.

- Introduced syntactic and part-of-speech annotations for millions of words
- Shifted NLP from rule-based to probabilistic, data-driven approaches
- Enabled breakthroughs in syntactic parsing, machine translation, and statistical models

- **BioBERT (2020s)**

Lee, J. et al. (2020). BioBERT: a pre-trained biomedical language representation model for biomedical text mining. *Bioinformatics*, 36(4), 1234-1240.

- Leveraged annotated biomedical texts to outperform general NLP models
- Specialized data was key to success in domain-specific tasks (e.g., NER, relation extraction)
- Triggered a trend in fine-tuning models on annotated, domain-specific datasets

Before We Move on...

Gemini 1.5 Pro also shows impressive “in-context learning” skills, meaning that it can learn a new skill from information given in a long prompt, without needing additional fine-tuning. We tested this skill on the [Machine Translation from One Book \(MTOB\)](#) benchmark, which shows how well the model learns from information it’s never seen before. When given a [grammar manual](#) for [Kalamang](#), a language with fewer than 200 speakers worldwide, the model learns to translate English to Kalamang at a similar level to a person learning from the same content.

Context	GPT-4		Claude 3		Gemini 1.5		Human language learner
	Turbo	Haiku	Sonnet	Opus	Flash	Pro	
0-shot	0.14 (30.0)	0.24 (33.4)	0.14 (30.0)	0.18 (32.7)	0.14 (31.5)	0.18 (30.0)	-
half book	2.04 (49.7)	2.80 (53.5)	3.40 (58.5)	3.74 (58.3)	3.00 (55.1)	4.14 (63.9)	-
full book	-	-	-	-	3.14 (57.4)	4.00 (64.6)	5.52 (70.3)

Table 4 | Quantitative results for Kalamang→English translation on MTOB (Tanzer et al., 2023). We present human evaluation scores on a scale of 0 to 6, with 6 being an excellent translation. We include automatic metrics (BLEURT) in parentheses.

Context	GPT-4		Claude 3		Gemini 1.5		Human language learner
	Turbo	Haiku	Sonnet	Opus	Flash	Pro	
0-shot	0.08 (15.0)	0.08 (15.3)	0.08 (17.3)	0.12 (18.7)	0.08 (15.4)	0.00 (12.0)	-
half book	3.90 (45.4)	4.46 (51.7)	4.64 (49.2)	5.18 (55.5)	4.94 (54.6)	5.38 (59.1)	-
full book	-	-	-	-	4.66 (52.0)	5.46 (59.0)	5.60 (57.0)

Table 5 | Quantitative results for English→Kalamang translation on MTOB (Tanzer et al., 2023). We present human evaluation scores on a scale of 0 to 6, with 6 being an excellent translation. We include automatic metrics (chrF) in parentheses.

Kalamang language: 250K tokens in total

- field linguistics documentation, ~500 p grammar
- ~2000-entry bilingual wordlist
- ~400 additional parallel sentences

Gemini 1.5 be like



...So, Should We Even Bother?

Indeed, if a large enough LM can solve such tasks given just a textbook — in a couple of years our LRL-related efforts will be for nothing? *

- **Language Diversity:** each language encodes unique cultural knowledge; success with one doesn't ensure success with others (though one should check!)
- **Cultural Preservation:** less-resourced languages preserve cultures and histories
- **Model Limitations:** generalization of one model (e.g., Gemini 1.5) does not guarantee performance across diverse languages (though one should check!)
- **Innovation & Research:** tackling LRLs drives novelties that benefit all NLP
- **Human Oversight:** all NLP tasks still need human review, e. g. in edge cases and cultural nuances



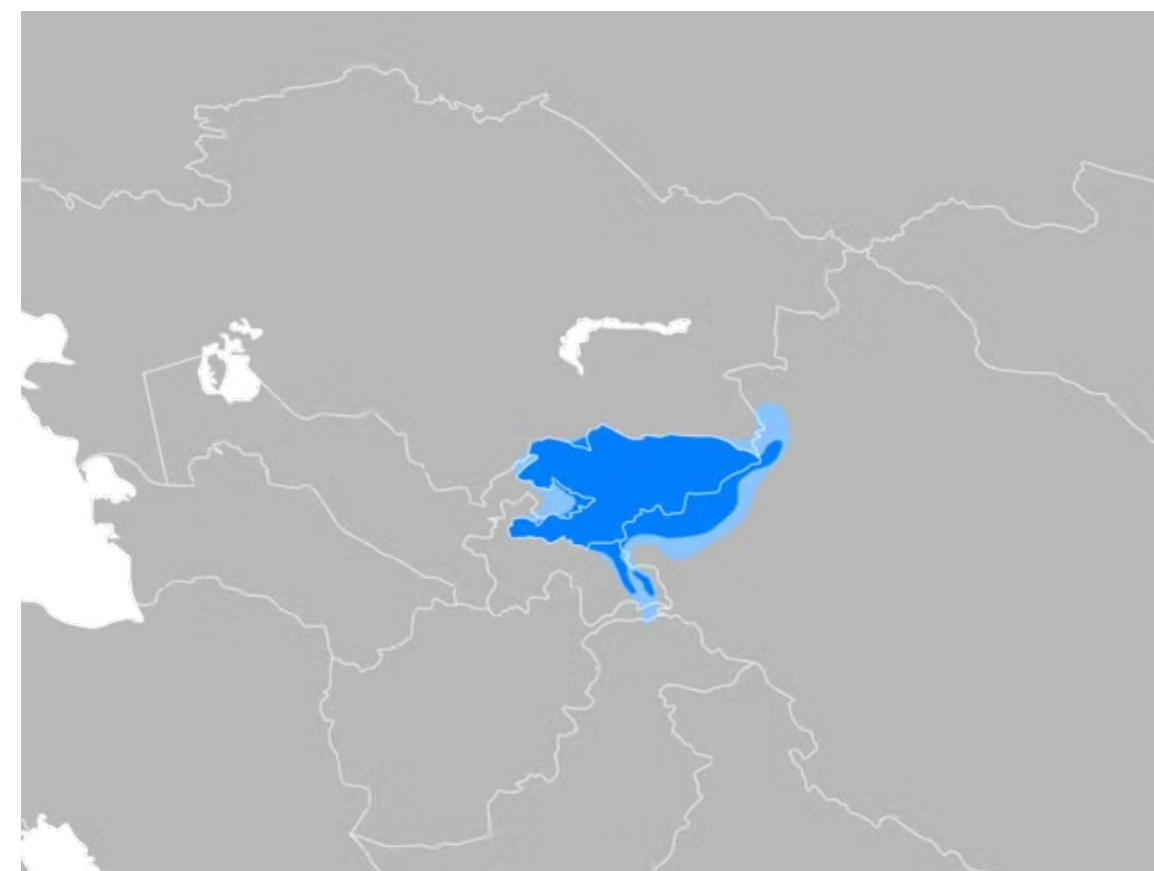
We should constantly evaluate whatever people call 'AI' or even good old 'intelligent systems'

Kyrgyz Language

What, Why, and How

Kyrgyz Language

Native to	Kyrgyzstan, Afghanistan, Tajikistan, Pakistan, China
Region	Central Asia
Ethnicity	Kyrgyz
Native speakers	5.15 million* (Institutional)
Language family	Turkic <ul style="list-style-type: none">• Common Turkic<ul style="list-style-type: none">• Kipchak<ul style="list-style-type: none">• Kyrgyz–Kipchak<ul style="list-style-type: none">• Kyrgyz
Dialects	Northern, Southern Pamiri Kyrgyz
Official language in	Kyrgyzstan, China (Kizilsu Kyrgyz Autonomous Prefecture)
Closest languages	*Kazakh (91%), Tatar(79%), Uyghur(77%), Uzbek(76%), Altai(73%)



Kyrgyz Language | Кыргыз тили | قيرغيزچا

Kyrgyz alphabets

Cyrillic script, Perso-Arabic script (China, Afghanistan, Pakistan)

Cyrillic alphabet (1938-present)	Old Latin alphabet (1928-1938)	Arabic alphabet (pre 1928)	Old Turkic alphabe (8th - 10th centuries)	English translation
<p>Бардык адамдар өз беделинде жана укуктарында эркин жана тең укуктуу болуп жаралат. Алардын аң-сезими менен абийири бар жана бири-бирине бир туугандык мамиле кылууга тийиш.</p>	<p>Bardьq adamdar өз vedeline çana uquqtarьnda erkin çana ten uquqtuu volup çaralat. Alardьn aң-sezimi menen avijiri var çana biri-birine bir tuuqandьq mamile qьluuqa tijiш.</p>	<p>باردىق ادامدار وز بهدملئنده جانا وُقۇقتارىندا مركئن جانا تهْ وُقۇقتو وُقۇ جانا تھْ وُقۇقتو وُقۇ بولۇپ جارالات. الاردىن اڭ-سزىمى مەنەن ابىيىرى بار جانا بىرى-بىرىنە بىر تۇغۇندە بىر تۇ وۇ عاندىق مامئە قىلۇ وۇ عا تئىش</p>	<p>.</p> <p>-</p> <p>-</p> <p>.</p>	<p>All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.</p>

Challenges

1. Machine-readable language resources and evaluation/training datasets are scarce
2. Most machine-readable data for training are news articles, a very *special* domain
3. Kyrgyz language exists in multiple scripts: Perso-Arabic (China) and Cyrillic (Kyrgyzstan) and dialects
4. Agglutinative languages sometimes require complex preprocessing techniques, e. g.
 - a verb in Russian can have a maximum of ~150 written forms
 - in Kyrgyz, this number can achieve **thousands**

камсызда → камсыздандырылбагандардыкындагылардансыздарбы?
5. Several *decentralized* corpora-building initiatives so far; a large National Corpus is yet to be built

Earlier Surveys of Kyrgyz NLP [1/2]

2012: Problems and Prospects for the Development of Computational Linguistics in Kyrgyzstan

by Мусаев, С. Ж., Карабаева, С. Ж., Иманалиева, А.И. in TurkLang-2013

Mentioned interest groups:

- Institute of Theoretical and Applied Mathematics of the NAS of KR
- КГУСТА (KSU of Construction, Transportation and Architecture); later merged with KSTU: computational linguistics department
- Research under Prof. P. S. Pankov
- Work under E. D. Asanov: "Tamga-KIT", "KyrSpell", etc.

The overview starts from 1990

The following linguistic problems are mentioned:

- (1) dev. of a unified word formation algorithm for the Kyrgyz language,
- (2) creation of comp. language models and linguistic resources at the Department of CL,
- (3) the need for language-independent representations of objects in various subject areas,
- (4) challenges in handling Kyrgyz spelling and orthography, including spell-checking, hyphenation rules, and managing synonyms and antonyms in the Kyrgyz language,
- (5) standardization of Kyrgyz orthography,
- (6) the need for the transition to a Latin alphabet and the design of a unified word formation algorithm for all Turkic languages

Earlier Surveys of Kyrgyz NLP [2/2]

2024. Recent Advancements and Challenges of Turkic Central Asian Language Processing

by Y. Veitsman (Saarland University) on arxiv

lack of labeled data for the downstream tasks. Uzbek, given its recent developments and greater variability in terms of the linguistic resources available, would be categorized as “The Hopeful,” given that in the next years the efforts for collecting the datasets will not fade. Kyrgyz and Turkmen, unfortunately, not being sufficiently backed up by streamlined research efforts, would be classified as “The Scraping-Bys,” with the future of their data collection processes yet unclear.

Just as in the paper (Mirzakhlov et al., 2021), the author diagnoses Kyrgyz as 'Scraping By' (Joshi et al., 2020)

The author blames

- lack of initiatives (though HTP is mentioned)
- Russian language as lingua franca in Central Asia
- limited Internet access

Summary: some progress in data collection and NLP, yet challenges remain (more resources and data required)

Suggestions: (1) collect more high-quality data,
(2) focus on **transfer learning** from Kazakh and Turkish,
(3) employ LLMs for **data augmentation**

1 - The Scraping-Bys With some amount of unlabeled data, there is a possibility that they could be in a better position in the ‘race’ in a matter of years. However, this task will take a solid, organized movement that increases awareness about these languages, and also sparks a strong effort to collect labelled datasets for them, seeing as they have almost none.

Kyrgyz NLP Resources

Diving Ourselves

Kyrgyz NLP Scientometrics [1/5]: the Collection Procedure

Set of **66** research works on Kyrgyz language processing

1. *TurkLang* papers: word 'kyrgyz' in the title or abstract
2. Relevant works cited in these papers
3. Papers from the publications lists of the corresponding *TurkLang* authors
4. Filtering out irrelevant works
(e.g. non-NLP papers, or works with neither computational/
data-based approaches nor quantitative justifications)
5. Directly *google-scholar-ed* the rest
(journal publications, other notable venues)



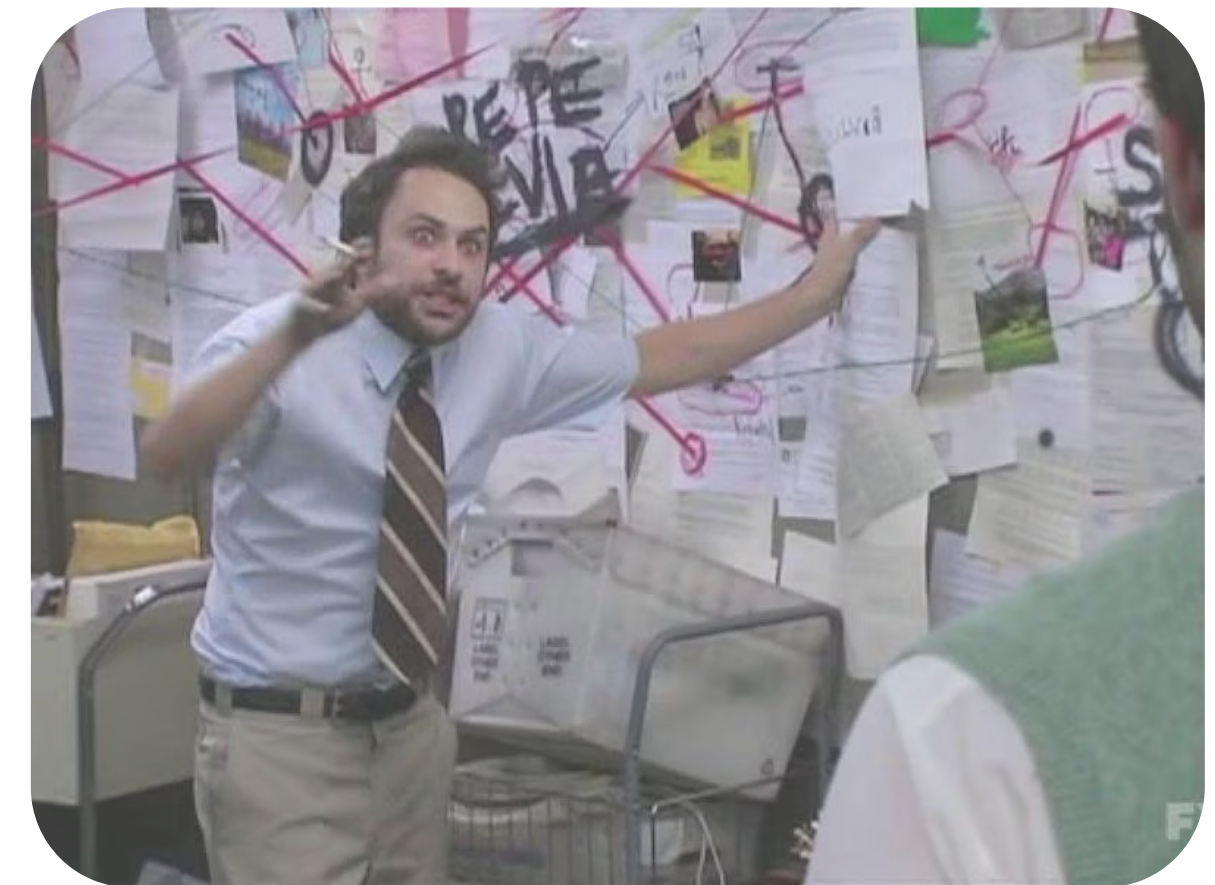
Kyrgyz NLP Scientometrics [1/5]: the Collection Procedure

The survey we're preparing is the first review of Kyrgyz NLP of this scale

Again: works on tasks common *for Turkic languages in general* were excluded

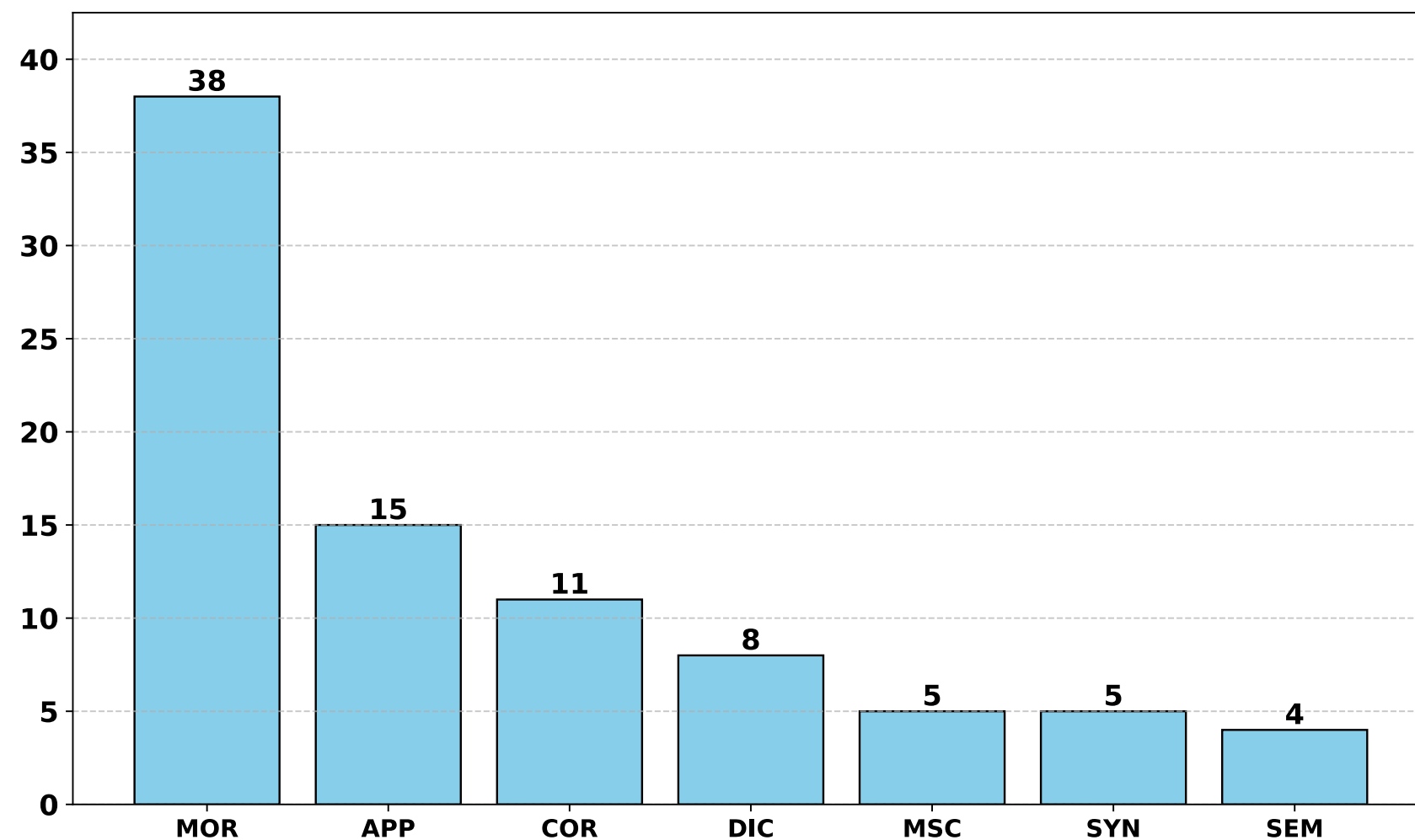
Again: works ...-2011 are poorly represented in our list, especially books

- Disclaimer:** the list may not be comprehensive, likely missed a few papers (sorry in advance!), yet it
- provides insights into the structure of the field,
 - includes the works of those who presented some of their works on undoubtedly relevant conferences



https://en.meming.world/wiki/File:Pepe_Silvia.jpg/

Kyrgyz NLP Scientometrics [2/5]: Branches/Topics



MOR: morphology-related works, character-level

SYN: syntax-related papers

SEM: works related to semantics

COR: corpus studies

DIC: dictionaries construction and usage

APP: other NLP tasks: MT, topic classification, etc.

MSC: miscellaneous (general surveys, etc.)

Kyrgyz NLP Scientometrics [5/5]

Much more can be analyzed here!

- connecting the position (e.g. betweenness centrality) in the network to the indicators of performance
- carrying out a more comprehensive search of relevant works and possible collaborators
- build a citation graph and find the most impactful works
- compute statistics of venues where works are presented

MOR: Finite-State Transducers for Morphology Modeling

Washington J. N., Ipasov M., Tyers F. M. A finite-state morphological transducer for Kyrgyz //LREC. – 2012. – C. 934-940.

Washington J. N., Salimzyanov I., Tyers F. M. Finite-state morphological transducers for three Kypchak languages //LREC. – 2014. – C. 3378-3385.

Washington J. N., Tyers F. M., Kuyrukçu O. Multi-script morphological transducers and transcribers for seven Turkic languages //Proceedings of the Workshop on Turkic and Languages in Contact with Turkic. – 2020. – T. 5. – C. 173-185.

MOR: Rule-based Modeling of Different Aspects of Morphology

Панков П. С. Обучающая и контролирующая программа по словоизменению в кыргызском языке на ПЭВМ //Бишкек: Мектеп. – 1992. – С. 20.

Yiner Z. et al. Kyrgyz orthography and morphotactics with implementation in NUVE //Proceedings of International Conference on Engineering and Natural Sciences. – 2016. – С. 1650-1658.

Sadykov, T., & Kochkonbayeva, B. (2017). Model of morphological analysis of the Kyrgyz language. In *Proceedings of the V International Conference on Computer Processing of Turkic Languages Turklang* (Vol. 2, pp. 135–154)

Кочконбаева Б. О. О морфологическом анализе в приложениях автоматической обработки текст //Бюллетень науки и практики. – 2018. – Т. 4. – №. 12. – С. 608-612.

Садыков Т., Кочконбаева Б. Об оптимизации алгоритма морфологического анализа //Шестая Международная конференция по компьютерной обработке тюркских языков «Turklang-2018».(Труды конференции)–Ташкент. – 2018

Israilova, N. A., & Bakasova, P. S. (2019). Ontological models of morphological rules of the Kyrgyz language. In *Proceedings of the Seventh International Conference on Computer Processing of Turkic Languages "TurkLang 2019"* (Simferopol, Crimea, Russia, October 3–5, 2019)

Сатыбаев А. Д., Кочконбаева Б. О. Тестирование программы морфологического анализатора естественного языка //Бюллетень науки и практики. – 2019. – Т. 5. – №. 3. – С. 215-219.

Кочконбаева Б. О., Эгембердиева Ж. С. Modeling of Morphological Analysis and Synthesis of Word Forms of the Natural Language // Бюллетень науки и практики. – 2020. – Т. 6. – №. 9. – С. 435-439.

Nazirova, E., Abdurakhmonova, N., Abidova, Sh., & Uzakova, M. (2023). Morphological analysis of word forms in Uzbek, Karakalpak, and Kyrgyz languages, which belong to the Turkic language family. In *TurkLang* (Bukhara, 2023).

MOR: Other Algorithmic Aspects of Morphological Analysis

Бакасова П. С., Исраилова Н. А. Алгоритм образования словоформ для автоматизации процедуры пополнения базы данных словаря //Известия Кыргызского государственного технического университета им. И. Раззакова. – 2016. – №. 2. – С. 23-27.

Israilova N. A., Bakasova P. S. Morphological analyzer of the Kyrgyz language //Proceedings of the V International Conference on Computer Processing of Turkic Languages Turklang. – 2017. – Т. 2. – С. 100-116.

Исраилова Н. А. Алгоритм морфологического анализа и синтеза в трансляторе //Современные проблемы механики. – 2017. – №. 28. – С. 11-19.

Шарипбай А. А. и др. Сравнение онтологических моделей существительных казахского и кыргызского языков //Сборник содержит материалы Шестой Международной конференции по компьютерной обработке тюркских языков «TurkLang-2018»(Ташкент, Узбекистан, 18–20 октября 2018 г.). – 2018.

Tukeyev U., Karibayeva A., Zhumanov Z. Morphological segmentation method for Turkic language neural machine translation //Cogent Engineering. – 2020. – Т. 7. – №. 1. – С. 1856500.

Toleush A., Israilova N., Tukeyev U. Development of morphological segmentation for the Kyrgyz language on complete set of endings //Intelligent Information and Database Systems: 13th Asian Conference, ACIIDS 2021, Phuket, Thailand, April 7–10, 2021, Proceedings 13. – Springer International Publishing, 2021. – С. 327-339.

Tukeyev U. A NEW COMPUTATIONAL MODEL FOR TURKIC LANGUAGES MORPHOLOGY AND PROCESSING //Journal of Problems in Computer Science and Information Technologies. – 2023. – Т. 1. – №. 1.

MOR: Working with Perso-Arabic Script

Li Z. et al. AgglutiFiT: Efficient low-resource agglutinative language model fine-tuning //IEEE Access. – 2020. – T. 8. – C. 148489-148499.

Li X. et al. Low-resource text classification via cross-lingual language model fine-tuning //China National Conference on Chinese Computational Linguistics. – Cham : Springer International Publishing, 2020. – C. 231-246.

Ablimit M. et al. A multilingual language processing tool for Uyghur, Kazak and Kirghiz //2017 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC). – IEEE, 2017. – C. 737-740.

SYN: Recent Works on Computational Syntax

2023	UD_Kyrgyz-KTMU: UD for Kyrgyz by İbrahim Benli (on GitHub)	A treebank annotated with dependency relations: 781 sentences from unspecified sources (Hemingway translation to Kyrgyz, news articles, etc.); no paper yet (as of October 2024).
2023	Г.К. Джумалиева, А.А. Касиева, С.Ж. Мусажанова. АДАПТАЦИЯ ТЕРМИНОВ ВЕБ-ПРОЕКТА УНИВЕРСАЛЬНЫЕ ЗАВИСИМОСТИ НА КЫРГЫЗСКИЙ ЯЗЫК // Вестник КРСУ. 2023. Т. 23. № 6. С. 71-75.	Adapts Universal Dependencies (UD) for Kyrgyz, focusing on syntactic annotation. Provides examples of how UD's structures apply to Kyrgyz . Based on UD's existing platforms.
2023	Musazhanova, S., Kasieva, A., & Dzhumalieva, G. (2023). Syntactic Annotation of the Newly-Created Kyrgyz Corpus. Bulletin of the Issyk-Kul State University named after K. Tynystanov, 54(2), 139-148. IGU.	Syntactic annotation of the newly created Kyrgyz corpus, highlights issues in adapting Kyrgyz grammar to the UD framework. Provides dependency trees for parsing Kyrgyz sentences. No code provided, but the Kyrgyz corpus is manually annotated and will support further research and development.
2023	Kasieva, A., Dzhumalieva, G., Thompson, A., Jumashev, M., Chontaeva, B., & Washington, J. (2023). Issues of Kyrgyz Syntactic Annotation within the Universal Dependencies Framework. In TurkLang, Buxoro.	Examines issues in Kyrgyz syntactic annotation within UD framework: copula tokenization, small words, null-headed clauses, and distinguishing inflection vs derivation . In-depth analysis to improve Kyrgyz TB quality.
2024	UD_Kyrgyz-TueCL: UD for Kyrgyz by Chontaeva, Bermet; Çöltekin, Çağrı (with the support of UD Turkic Group and Kyrgyz team: J. Washington, A. Kasieva, G. Dzumalieva, A. Tursunova, M. Ryspakova, A. Kadyrbekova for their weekly informative meetings and discussions and for all the support we have received.)	145 sentences including 20 Cairo sentences, and ~ 100 sentences suggested by UD Turkic Group.

SEM: Recent Works on Computational Semantics (and Around)

2015	Karabaeva S., Dolmatova P., Imanalieva A. Computer-mathematical modeling of national specificity of spatial models in Kyrgyz language // Proceedings of TurkLang-2015. – 2015. – С. 416-422	Models spatial semantics in Kyrgyz , focusing on spatial terms and grammar. Models for representing these concepts, useful for NLP and educational tools for Turkic languages. No code provided, but models can be implemented.
2016	Карабаева С. Ж. Виртуальные геометрические объекты, создаваемые глаголами в кыргызском языке // В мире науки и искусства: вопросы филологии, искусствоведения и культурологии. – 2016. – №. 11 (66). – С. 74-79.	Models virtual geometrical spaces created by verbs in Kyrgyz , focusing on how these verbs define spatial relations and motion. Models for representing these spaces, useful for Kyrgyz LP and linguistic analysis. No code provided, models can be experimentally tested and implemented.
2022	Касиева А. А., Кадырбекова А. К. КЫРГЫЗ ТИЛИНДЕГИ ЭТИШТЕРДИН КОШ МААНИЛҮҮЛҮГҮН ЖОЮУ (жаңы түзүлгөн кыргыз тилинин корпусунун негизинде)//ИЗВЕСТИЯ ВУЗОВ КЫРГЫЗСТАНА. — 2022. — №6. — С. 341-345	Models verb sense disambiguation (VSD) in Kyrgyz. Presents rule-based methods for VSD automation , useful for NLP and corpus linguistics in agglutinative languages. No code provided, but approaches are implemented using the newly created Kyrgyz corpus.
2023	А. М. Алексеев, Г. Д. Кабаева. НЖ-Ку-0.1: набор данных для оценки качества векторных представлений слов кыргызского языка // Известия КГТУ им. И. Раззакова. – 2023. – № 4(68). – С. 1806-1814.	Word embeddings evaluation dataset construction via direct translation of RUSSE benchmark; several models are evaluated. Prepared prior to the releases of Kyrgyz-focused contextual models such as the next one. Waits to be re-annotated, available on request.
2024	Shliazhko, O., Fenogenova, A., Tikhonova, M., Kozlova, A., Mikhailov, V., & Shavrina, T. (2024). mGPT: Few-Shot Learners Go Multilingual. Transactions of the Association for Computational Linguistics, 12, 58-79.	LLMs go brrrr! GPT-3 model for Kyrgyz language, freely available. https://huggingface.co/ai-forever/mGPT-1.3B-kirgiz

COR: Corpora-Related Works

A few works related to the National Corpora and other resources has already been mentioned earlier

2013	Садыков Т., Шаршембаев Б. Манас” эпосунун улттук корпусун түзүү жөнүндө //Компьютерная обработка тюркских языков. Первая международная конференция: Труды.-Астана: ЕНУ им. ЛН Гумилева.- 148-154 б. - 2013.	Discusses the creation of a national corpus of the Kyrgyz "Manas" epic; corpus linguistics techniques to analyze and document its vocabulary and grammar. Framework for building a searchable dictionary of the epic's texts , useful for linguistic research and preserving Kyrgyz heritage. No code is provided, the corpus is said to be under development and supposed to serve as a key resource for future computational projects.
2015	Baisa V., Suchomel V. Turkic language support in Sketch Engine //PROCEEDINGS OF THE INTERNATIONAL CONFERENCE" TURKIC LANGUAGES PROCESSING" TurkLang-2015. - 2015. - С. 214-223.	Turkic language support in Sketch Engine, focusing on building corpora and providing tools for analysis in Kazakh, Kyrgyz, and Turkish. Presents methods for web-crawling, concordance searches, and word sketches, useful for advancing corpus linguistics and NLP for under-resourced Turkic languages.
2020	Kasieva A.A. PARTS-OF-SPEECH ANNOTATION OF THE NEWLY CREATED KYRGYZ CORPUS (Turkic Lexicon Apertium Tools) / A.A. Kasieva, A.T. Satybekova // Herald of KRSU. 2020. T. 20. No 6. S. 67-72.	Focuses on part-of-speech (POS) annotation for the newly created Kyrgyz language corpus, utilizing the Turkic Lexicon Apertium platform. Provides detailed examples of tagging and morphological analysis, useful for further development of Kyrgyz linguistic resources and corpus-based NLP applications.

APP: Applied NLP (Analysis and Rule-Based)

2018	Polat, Y., Zakirov, A., Bajak, S., Mamatzhanova, Z., & Bishkek, K. (2018). Machine Translation for Kyrgyz Proverbs—Google Translate Vs. Yandex Translate-From Kyrgyz into English and Turkish. In <i>Сборник материалов Шестой Международной конференции «TurkLang-2018»</i> (Ташкент, Узбекистан, 18–20 октября 2018 г.)	Compares the accuracy of Google Translate and Yandex Translate for translating Kyrgyz proverbs into English and Turkish, focusing on lexical, semantic, and syntactic performance. Concludes that Google Translate performs better overall, particularly in handling Kyrgyz's agglutinative structure, though both systems struggle with proverbs. No code is provided, but error analysis reveals key challenges for improving Kyrgyz machine translation.
2016	Кочконбаева Б. О. Табигый тилдеги тексттерди орус тилинен кыргыз тилине машиналык которууда сездерду анализдөөн алгоритмин тузуу //Известия Кыргызского государственного технического университета им. И. Раззакова. – 2016. – №. 2. – С. 52-54.	Develops an algorithm for machine translation from Russian to Kyrgyz, focusing on morphological and syntactic analysis. Provides a framework for processing affixes and word formation in Kyrgyz, useful for improving translation accuracy between these languages in automated systems. No specific code is provided, but a morphological analyzer was developed using Delphi, with a database of common Russian words.
2019	Washington, J. N., Salimzianov, I., Tyers, F. M., Gökırmak, M., Ivanova, S., & Kuyrukçu, O. (2019). Free/open-source technologies for Turkic languages developed in the Apertium project. In <i>Proceedings of the International Conference on Turkic Language Processing (TURKLANG 2019)</i> (pp. 30-71).	Describes free and open-source technologies for Turkic languages developed in the Apertium project, including morphological transducers and machine translation systems for languages like Kazakh, Kyrgyz, and Tatar. Provides tools to support language revitalization and linguistic rights, useful for developing NLP resources in under-resourced Turkic languages. All code is available, and technologies are production-ready for several languages.
2018	Kochkonbaeva, Buazhar and Aldosova Aziza. "Automatic processing of text in natural language." <i>Бюллетень науки и практики</i> 4.7 (2018): 216-221.	Focuses on automatic processing of Kyrgyz text, proposing an algorithm for wordform analysis and morphological tagging. Presents a method to identify word stems and affixes, useful for developing NLP tools like machine translation and information retrieval for the Kyrgyz language. No code is provided, but the algorithm can be applied in various text processing systems.

APP: Applied NLP (MT by Turkic Interlingua)

2021

Mirzakhlov, J., Babu, A., Kunafin, A., Wahab, A., Moydinboyev, B., Ivanova, S., ... & Chellappan, S. (2021, November). Evaluating Multiway Multilingual NMT in the Turkic Languages. In *Proceedings of the Sixth Conference on Machine Translation* (pp. 518-530).

Mirzakhlov, J., Babu, A., Ataman, D., Kariev, S., Tyers, F., Abduraufov, O., ... & Chellappan, S. (2021, November). A Large-Scale Study of Machine Translation in Turkic Languages. In *Proceedings of the 2021 Conference on Empirical Methods in Natural Language Processing* (pp. 5876-5890).

Evaluates **multiway** multilingual neural machine translation (MNMT) for Turkic languages: 22 languages, most are low-resource. Comparison between bilingual baselines and MNMT models, demonstrating that MNMT performs better **in out-of-domain tasks**, useful for enhancing machine translation in under-resourced Turkic languages.

All code and models are made publicly available for further research and development

In-domain results: bilingual baselines sometimes outperform MNMT models for Kyrgyz when dealing with domain-specific translations

APP: Applied NLP (Other)

2008	Tohti, T., Musajan, W., & Hamdulla, A. (2008, July). Character code conversion and misspelled word processing in Uyghur, Kazak, Kyrgyz multilingual information retrieval system. In <i>2008 International Conference on Advanced Language Processing and Web Information Technology</i> (pp. 139-144). IEEE.	Solutions for character code conversion and spelling error correction in Uyghur, Kazak, and Kyrgyz for multilingual information retrieval. Methods for converting non-Unicode characters to Unicode and root-based query expansion to handle spelling errors, improving search accuracy and recall in these languages. No specific code is provided, but algorithms for character conversion and query correction are tested within the system.
2023	Alekseev A., Nikolenko S., Kabaeva G. Benchmarking Multilabel Topic Classification in the Kyrgyz Language //International Conference on Analysis of Images, Social Networks and Texts. – Cham : Springer Nature Switzerland, 2023. – C. 21-35.	Presenting a new manually labeled dataset of news articles from 24.kg . Provides several baseline models, showing that multilingual neural models like XLM-RoBERTa perform best, useful for advancing Kyrgyz-language NLP tools. No specific code is provided, but the dataset and models are planned for public release.
2024	Senel, L. K., Ebing, B., Baghirova, K., Schütze, H., & Glavaš, G. (2024, March). Kardeş-NLU: Transfer to Low-Resource Languages with the Help of a High-Resource Cousin–A Benchmark and Evaluation for Turkic Languages. In <i>Proceedings of the 18th Conference of the European Chapter of the Association for Computational Linguistics (Volume 1: Long Papers)</i> (pp. 1672-1688).	Introduces the Kardes-NLU benchmark, focusing on cross-lingual transfer from Turkish to less resourced Turkic languages like Kyrgyz. Presents strategies for improving natural language understanding tasks through intermediate training and fine-tuning with Turkish, showing significant gains in accuracy for Kyrgyz, useful for NLP advancements in low-resource languages. All code and models are publicly available for further research and applications.

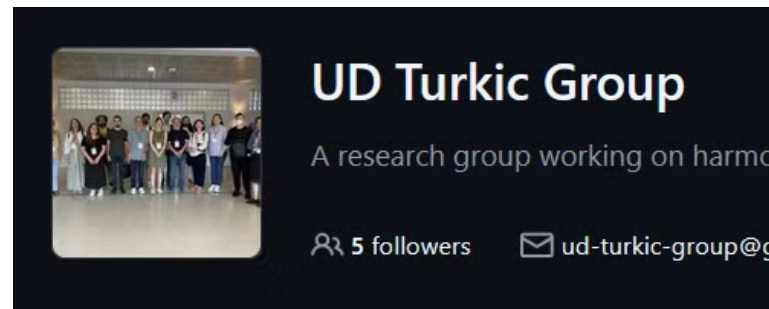
Kyrgyz NLP Analysis: Lessons Learned So Far

*Correlation doesn't imply causation**, however, some ideas are clear

1. **Collaboration** and diverse expertise within the research team **do matter**
(MT and UD papers would not be possible without Turkic languages interests groups)
2. We haven't analyzed the citations yet; from what we've seen in references lists:
the textbooks and other **educational and systematizing materials** are important
3. Data and tools are useful yet scarce, a lot of **opportunities to make something new**;
instruments and resources are in high esteem \Rightarrow very **welcome at top-ranked venues** (and cited)
4. **Online presence** is important for research visibility
(some projects didn't make it into this talk because we could not find any digital traces)

Join SIGTURK

<https://sigturk.github.io/>



<https://github.com/ud-turkic>

Other Datasets & Language Resources for Kyrgyz

- **Corpora:**

Manas-UdS: 1.2M words, 84 literary texts, 5 genres: novel, novelette, epic, minor epic, and fairy tale; lemmata, PoS tags, rich per-text metadata.

kkWaC: Kyrgyz corpus from the web, 19M words, Jan 2012

Kyrgyz in Leipzig Corpora Colleccion: Community data / Newscrawl (1M sentences) / Wikipedia (300K sentences)

TilCorpusu by the Cramer project: Kyrgyz corpus, 300M words, news+fiction, made public in Dec 2023

Kyrgyz language hand-written letters (Kyrgyz MNIST): hand-written Kyrgyz alphabet letters collection for machine learning applications; original images (a total of 80213) have been transformed to 50x50 images, then to CSV format

- **Morphology & Syntax:**

UD project comments on difficulties in Turkish language processing, might bring light to the question why parsing Kyrgyz is hard as well

KTMU's UD Treebank, 781 sentences

- **Named Entity Recognition:**

WikiANN has a Kyrgyz language part

KyrgyzNER: [not published yet]

- **Word Similarity Data**

Kyrgyz Word Embedding Evaluation: [not published yet]

Publicly Available Models: Specifically for Kyrgyz Language

1. The Cramer Project: Kyrgyz NER, Text-to-Speech model
2. Ulutsoft and Til Comission: Kyrgyz Text Completion (Mistral-7B-v0.1), Text-to-Speech
3. Kyrgyz NER model by Murat Jumashev

Our Contributions So Far [1/4]: Dataset Papers

Morphological segmentation dataset presented in

Садыков, Т. С., Туратали, Т., and Турдубаева, А. Б. Морфологический анализ для сбора текстовых данных в Национальном корпусе кыргызского языка. In TurkLang, Vuxoro, 2023.

News texts classification (on re-annotation; planning to run a data science competition)

Alekseev, A., Nikolenko, S., & Kabaeva, G. (2023). Benchmarking Multilabel Topic Classification in the Kyrgyz Language. In Int. Conf. on Analysis of Images, Social Networks and Texts (pp. 21-35). Cham: Springer Nature CH.

Word Similarity Dataset (on re-annotation; planning to run a data science competition)

А. Алексеев, Г. Кабаева. Hj-ky-0.1: набор данных для оценки качества векторных представлений слов кыргызского языка. Herald of KSTU, 4, 2023

Kyrgyz Named Entity Recognition (the paper is being prepared)

Our Contributions So Far [2/4]: Research in Progress

- Kyrgyz Named Entity Recognition (3rd AI Datathon dataset; the paper is being prepared)
- Ongoing student projects @ SPbU:
 - ML-Based Aid for Kyrgyz Dependencies Annotation
 - Transferring NER Labels to the Translated Dataset
 - New Results on Kyrgyz News Texts Classification
translation into English, Kyrgyz fastText, more tuning (e.g. mGPT-1.3B-kirgiz) and prompting
- Plans to **setup up a website**: a curated list of Kyrgyz NLP papers based on this talk: bibliographical items, citations, search, analytics, automatic translations into English, etc.
This will hopefully **increase the visibility** of research and improve the **understanding of the field**



STAY TUNED!

Our Contributions So Far [3/4]: Online Resources & Services

The Cramer Project:

- Text-to-Speech dataset and model
- Datasets: 300m corpus, Kyrgyz MNIST, Kyrgyz NER, Kyrgyz Alpaca

Our Contributions So Far [4/4]: Online Resources & Services

- LLM (fine-tuning Llama)
- Kyrgyz spell checker model (based on BERT)
- Kyrgyz language evaluation benchmark (MMLU, Reading Comprehension)
- The Kyrgyz National corpus TBA

How LLMs Perform

Bonus Slide

How do LLMs for Kyrgyz Perform?

	MMLU (Math + History)
ChatGPT-o	93%
Claude Sonnet 3.5	93%
Llama3-70B	71%
Llama3.1-70B	73%

Community Efforts

El Pueblo Unido

Community Efforts

1. The Cramer Project

a. Kyrgyz NER model :

volunteers, KSTU students,
thanks to G. Kabaeva & G. Jumalieva

b. LLM dataset

2. Aya dataset by Cohere:

community-annotated

3. Kyrgyz MNIST dataset:

handwritten letters of the alphabet
annotated by schoolchildren, curated by I. Jumaev

4. AkyAI Assistant:

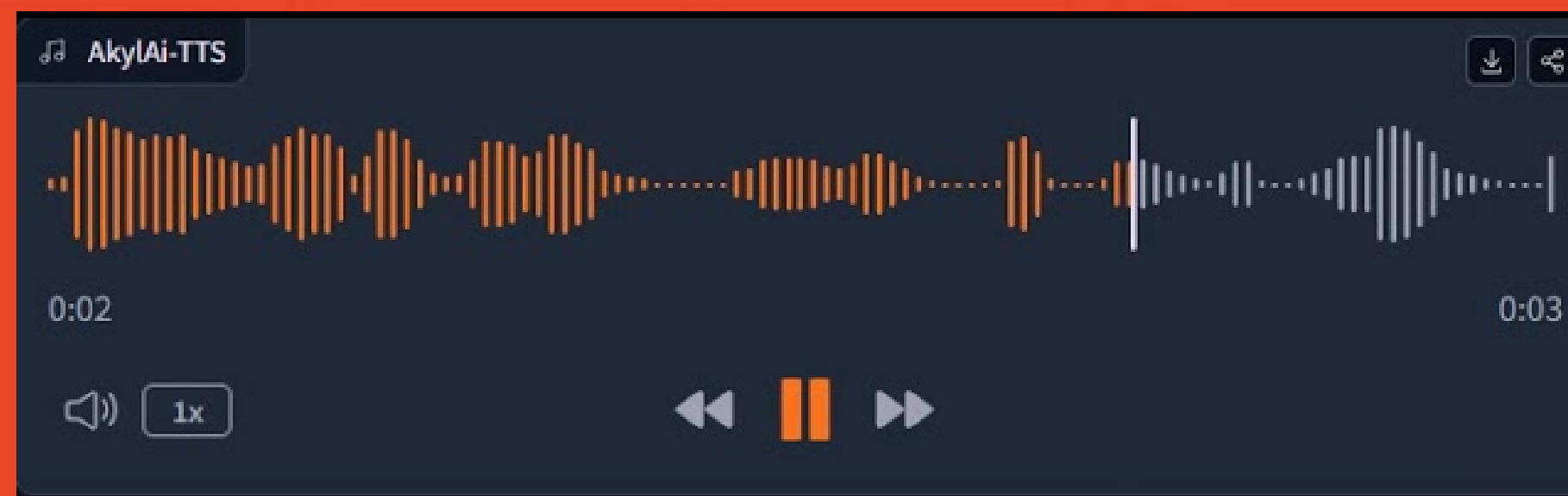
data collection and testing

100+
volunteers

15
AI experts

50
linguistics

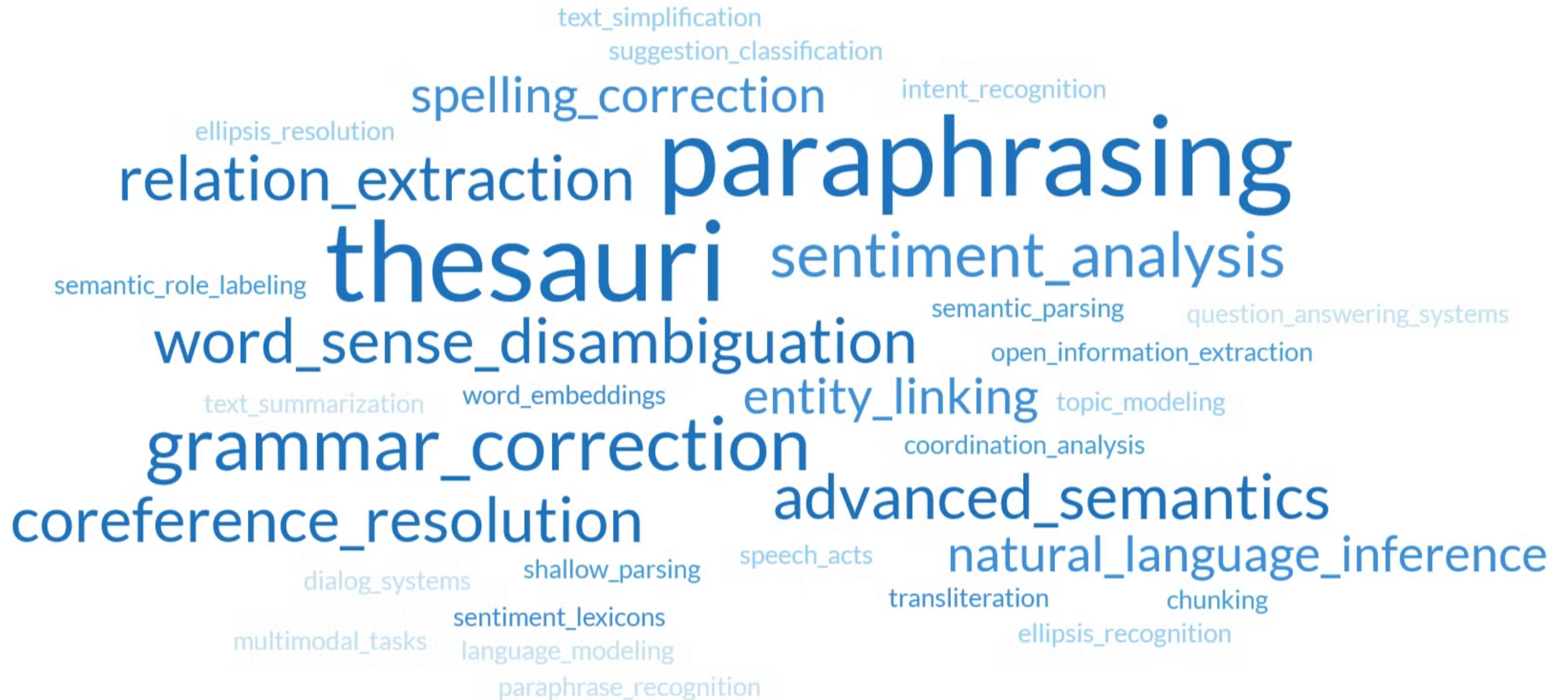
EXAMPLE OF COMMUNITY EFFORTS



Roadmap for Kyrgyz NLP

Humble Proposal

The Blue Ocean of the Unexplored: Enough Room for Everyone



Roadmap

What we suggest to pay attention to most closely

Try Pitch

Roadmap: Milestones

Data Collection and Annotation



1. Corpus Development
2. Data Cleaning and Preprocessing
3. Annotation for NLP Tasks

Community Involvement and Ecosystem Development



1. Partnerships with Academia
2. Developer and Researcher Engagement
3. Government and Private Sector Collaboration

Model Development and Training



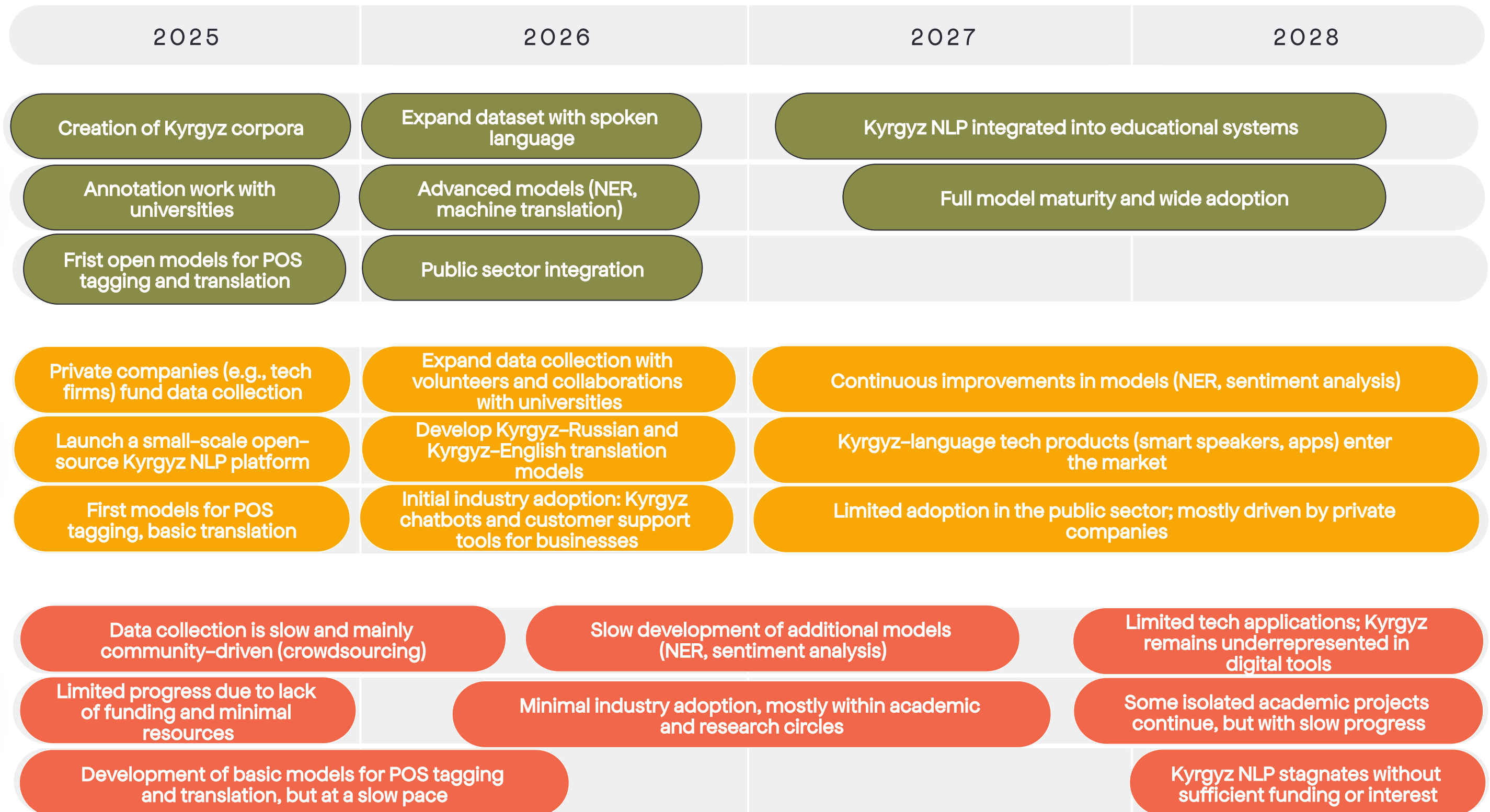
1. Basic Models for Key NLP Tasks
2. Kyrgyz-Bilingual Models
3. Transfer Learning and Pretrained Models
4. Open-Source Kyrgyz NLP Library

Deployment and Adoption



1. Integrating Kyrgyz NLP in Everyday Use
2. Ongoing Maintenance and Updates

Roadmap: Timeline



Conclusion

Don't Say Goodbye

01

Need More Minerals

Kyrgyz NLP needs more research, data, and collaborative activity to reach its potential

02

A Humble Proposal

We share our view on the directions of Kyrgyz NLP that should be paid attention to for the sake of sustainable advancement of the field and the related applications

03

El Pueblo Unido

The only chance for Kyrgyz language to stop being *Scraping By* is the close collaboration of the interested parties; taking this opportunity, we invite you to cooperate

The good news is that there is enough room for everyone in Kyrgyz NLP!

Thank you for your attention!
Көңүл бурганыңызга рахмат!

Questions and answers time?

Kyrgyz NLP: Challenges, Progress, and Future

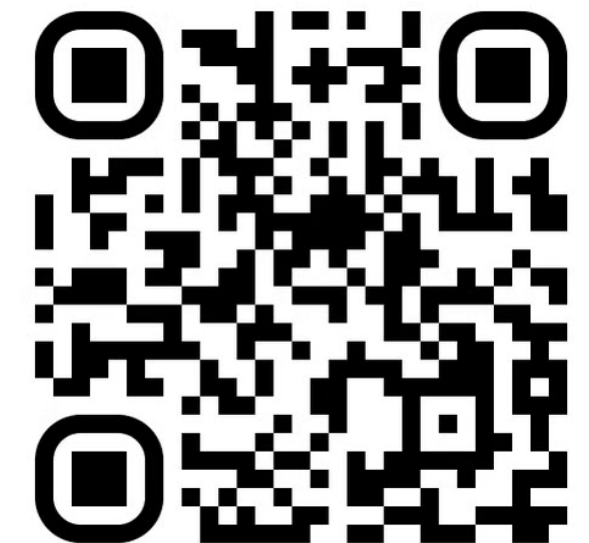
Anton Alekseev & Timur Turatali

PDMI RAS & SPbU (St. Petersburg, Russia), KFU (Kazan, Russia)
KSTU n.a. I. Razzakov, The Cramer Project (Bishkek, Kyrgyzstan)



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Bishkek, 2024