

Архитектура нейронных сетей: Трансформеры

Введение в курс

Содержание курса

ID	Date	Description	Sessions	Presenter
1	14.10	Transformer model. Motivation, original architecture and attention mechanism.	2	Maria Tikhonova
2	22.10	Transformer-based encoders. Masked language models based on the Transformer	2	Maria Tikhonova
3	24.10	Classification and sequence tagging with Transformers. Using encoders to generate feature representation for various NLU tasks.	2	Maria Tikhonova
4	29.10	Transformer-based decoders. Generation of text using Transformers. GPT and related decoders.	2	Victoriia Chekalina
5	31.10	Towards ChatGPT. Instruction tuning, einforcement Learning from Human Feedback (RLHF) and main modern LLMS	2	Maria Tikhonova
6	5.11	Sequence to sequence tasks. Machine translation, text detoxification, question answering, dialogue. Technical tricks for training and inference.	2	Irina Nikishina
7	7.11	Efficient Transformers. Pruning, Quantization, Distillation, parallelism on multiple GPUs: Varuna, Megatron pipelines	2	Victoriia Chekalina
8	12.11	Uncertainty estimation for Transformers and NLP tasks. Aleatoric and epistemic uncertainty. Out-of-domain detection methods.	3	Artem Vazhentsev
9	14.11	Multilingual language models based on the Transformer architecture.	2	Maria Tikhonova
10	19.11	Multimodal and vision Transformers. VQ-VAE. ViT, CLIP, Dall-E and related models. Generation with Kandinsky. Multimodal dialogue models.	2	Anton Razzhigaev
11	21.11	Transformers for event sequences. Classic time series and event sequence comparison. Peculiarities of event sequence modeling.	2	Vladislav Zhuzhel
12	26.11	Transformers for tabular data. Attention for tabular data. Tabular data architecture. Frameworks.	2	Maria Tikhonova
13	28.11	RAG with Transformers. Basic concept of Retriever-Augmented Generation. RAG-pipeline and frameworks. Introduction to AI Agents.	2	Maria Tikhonova
--	02.12	--	--	--
14	05.12	Deadline for all homework assignments. Final quiz.	2	Irina Nikishina
15	12.12	End of the course. Annoucement of the final scores.	4	Andrey Sakhovskiy, Elisey Rykov
		Assignments:		
		1) Knowledge graph question answering	-	Andrey Sakhovskiy
		2) Multilingual text detoxification	-	Elisey Rykov

Команда курса

Ведение лекций и семинаров

- **Мария Тихонова** (Сбер Девайсы, ВШЭ)
- **Виктория Чекалина** (AIRI, ex Сколтех)
- **Ирина Никишина** (Университет Гамбурга, ex Сколтех)
- **Антон Разжигаев** (Сколтех, AIRI)
- **Артем Важенцев** (Сколтех, AIRI)
- **Владислав Жужель** (Сколтех)
- **Андрей Саховский** (Сколтех, Сбер ИИ)
- **Елисей Рыков** (Сколтех, Т-банк ИИ)

Координация курса

- **Алексей Зайцев** (Сколтех)
- **Александр Панченко** (Сколтех, AIRI)

Формат курса

- 12 занятий по вторникам и четвергам, 18:00 - 20:20
 - Перерыв 10 мин между лекцией (1ч) и семинаром (1ч)
 - 10-15 мин на вопросы после каждой сессии
 - Читаем **на русском**, но слайды преимущественно **на английском**
 - как и большинство литературы в области NLP, Deep Learning
 - ArXiv, ACL Anthology, ICLR, NeurIPS, ... – важные международные источники исследовательских статей
 - AIST, AINL, Dialogue – преимущественно русскоязычное сообщество, однако тоже издаются на английском
 - Блоги (за исключением Хабра и некоторых телеграмм сообществ)
 - => для продвижения в области важно освоить чтение в источниках на английском!

GET READY TO LEARN (READ) IN ENGLISH :)

Почему рабочий язык – английский

- Подавляющая часть существующих материалов – на английском
- Терминология – на английском
- Статьи – на английском
- Основная терминология – транслитерация с английского (промтинг, трансформер, файнтьюнинг)

Мы обязательно будем помогать с терминологией и переводом, обязательно спрашивайте, если что-то непонятно!

Формат курса

Все задания – самостоятельные

- Вопросы по лекциям (оцениваются автоматически)
- Задания по семинарам (на дополнительные эксперименты к проведенному занятию)
- Две домашние работы (на решение комплексных задач)
- Финальный тест

Оценка = 40 + 40 + 20 + ??? = Д31 + Д32 + Тест + Бонус

Бонус = 1 балл за вопросы по лекции + 2 балла за задание по семинару

100 баллов – наивысшая оценка

Рекомендуемая литература

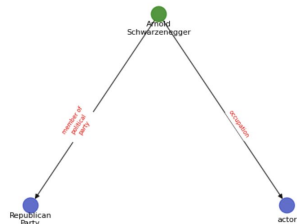
- Dan Jurafsky and James H. Martin (2021). Speech and Language Processing (3rd ed. draft). <https://web.stanford.edu/~jurafsky/slp3/>
- Denis Rothman (2021). Transformers for Natural Language Processing. <https://www.packtpub.com/product/transformers-for-natural-language-processing/9781800565791>
- The Hugging Face NLP course.
 - <https://huggingface.co/course>
 - <https://huggingface.co/learn/nlp-course/chapter1/1>

Домашние задания

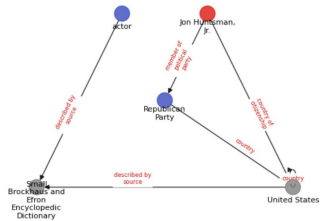
Домашние задания - мини проекты

Ответы на вопросы с использованием графа знаний и LLM

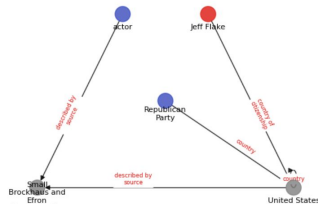
Who was formerly an actor and now a Republican senator?



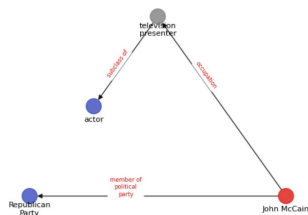
Who was formerly an actor and now a Republican senator?



Who was formerly an actor and now a Republican senator?



Who was formerly an actor and now a Republican senator?



Мультиязычная детоксификация текста

“ You idiot, stop talking of what you have no idea about!



“ I would suggest learning more about the subject to get a more productive conversation.

Детоксификация текста: нужно перефразировать из грубого в нейтральный и сохранить исходных смысл

toxic sentence	detoxified sentence
из за таких [] мы и страдаем	Из-за таких людей мы и страдаем
<i>translation:</i> We suffer from such []	<i>We suffer from such people</i>
[] знает кто кум, но девушка красивая 👍	неизвестно кто кум, но девушка красивая
<i>translation:</i> [] knows who the godfather is, but the girl is beautiful 👍	<i>it is unknown who the godfather is, but the girl is beautiful</i>
порядок бы [] навёл !	Порядок бы навел
<i>translation:</i> Put these [] things in order	<i>Put the things in order</i>

Детоксификация текста: нужно перефразировать из грубого в нейтральный и сохранить исходных смысл

“Multilingual Text Detoxification”

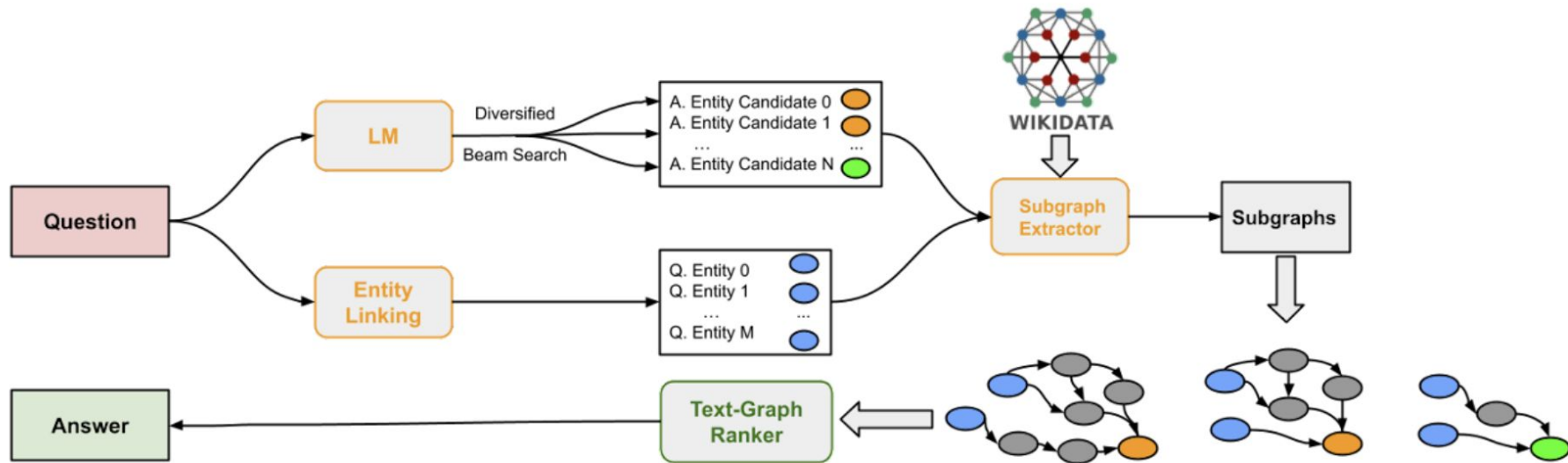
- Лидерборд: <https://codalab.lisn.upsaclay.fr/competitions/18243>
- Код: <https://github.com/pan-webis-de/pan-code/tree/master/clef24/text-detoxification>
- Информация о деталях задаче:
<https://pan.webis.de/clef24/pan24-web/text-detoxification.html>

Ответы на вопросы с использованием графа знаний и LLM

“Knowledge Graph Question Answering”

- Лидерборд: <https://codalab.lisn.upsaclay.fr/competitions/18214#>
- Код: <https://github.com/uhh-lt/TextGraphs17-shared-task/>
- Информация о деталях задаче:
<https://sites.google.com/view/textgraphs2024/home/shared-task>

Ответы на вопросы с использованием графа знаний и LLM



Ответы на вопросы с использованием графа знаний и LLM

question	questionEntity	answerEntity	groundTruthAnswerEntity
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Arnold Schwarzenegger	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Chuck Grassley	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Jeff Flake	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	John McCain	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Jon Huntsman, Jr.	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Lindsey Graham	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Mitch McConnell	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Orrin Hatch	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Rand Paul presidential campaign	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Rick Santorum	Arnold Schwarzenegger
Who was formerly an actor and now a Republican senator?	actor, Republican Party	Roy Blunt	Arnold Schwarzenegger

Система оценивания

Технический отчет		Код		Результаты		Сумма баллов
Методология	Анализ результатов	Читаемость	Воспроизводимость	Преодоление базового решения	Топ-1 +10 баллов Топ-20% +5 баллов	
5	5	5	5	0 / 5	0 / 5 / 10	25 (max 35)

Технический отчет

[Colab link](#)

2. Technical Report

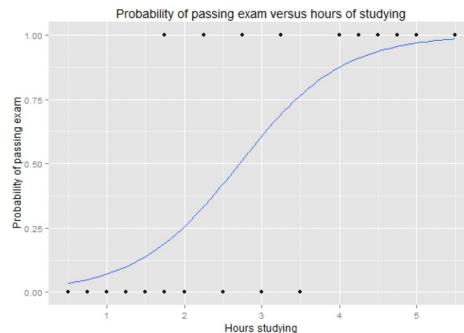
Use Section 2 to describe results of your experiments as you would do writing a paper about your results. DO NOT insert code in this part. Only insert plots and tables summarizing results as needed. Use formulas if needed to describe your methodology. The code is provided in Section 3.

2.1 Methodology

***Enter here** a detailed description of the method used in your submission(s) to Codalab. The description should be at least 2-4 paragraphs featuring the following: type of the model, meta-parameters, how did you select meta-parameters, any further modifications of the out-of-the-box solutions, etc. The text is markdown and you can use math environment to write formulas:*

$$\hat{y} = \beta_0 + \sum_{j=1}^p x_j \beta_j$$

Also you can insert images as needed:



This part of the should contain description of all methods that you tried and, most importantly, that worked the best for you. Here you can include some tricks of your preprocessing, description of the models and motivation of their usage, the description of the training process details (train-test split, cross-validation, etc.). So, everything valuable that will help us to understand the scope of your work and reproduce

Технический отчет

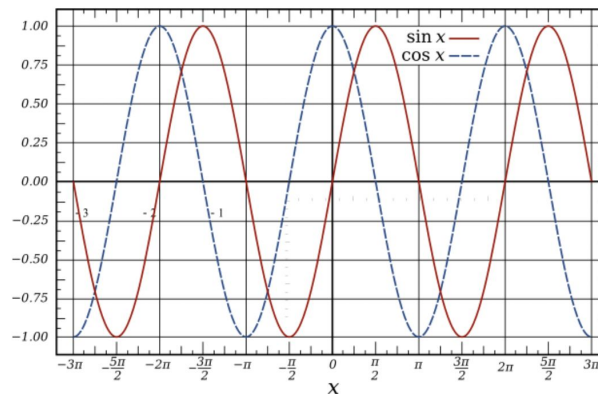
[Colab link](#)

2.2 Discussion of results

Enter here a discussion of results and a summary of the experiment. Here we want to see the final table with comparison of the baseline and all tried approaches you decided to report. Even if some method did not bring you to the top of the leaderboard, you should nevertheless indicate this result and a discussion, why, in your opinion, some approach worked and another failed. Interesting findings in the discussion will be a plus.

Method	Precision	Recall
Baseline	0.88	0.77
My great method 1	0.99	0.11
My great method 2	0.90	0.90

*If relevant insert plots and histograms in this section e.g. testing variation of the score with respect to some parameters e.g. learning rate or size of the input dataset, etc. Please do not use code to generate plots, instead just insert images as shown below. Plots could be generated from code in Section 3. *



Код

▾ 3. Code

Enter here all code used to produce your results submitted to Codalab. Add some comments and subsections to navigate through your solution.

In this part you are expected to develop yourself a solution of the task and provide a reproducible code:

- *Using Python 3;*
- *Contains code for installation of all dependencies;*
- *Contains code for downloading of all the datasets used;*
- *Contains the code for reproducing your results (in other words, if a tester downloads your notebook she should be able to run cell-by-cell the code and obtain your experimental results as described in the methodology section).*

As a result, your code will be graded according to these criteria:

- ***Readability:** your code should be well-structured preferably with indicated parts of your approach (Preprocessing, Model training, Evaluation, etc.).*
- ***Reproducibility:** your code should be reproduced without any mistakes with "Run all" mode (obtaining experimental part).*

▸ 3.1 Requirements

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▸ 3.2 Download the data

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▸ 3.3 Preprocessing

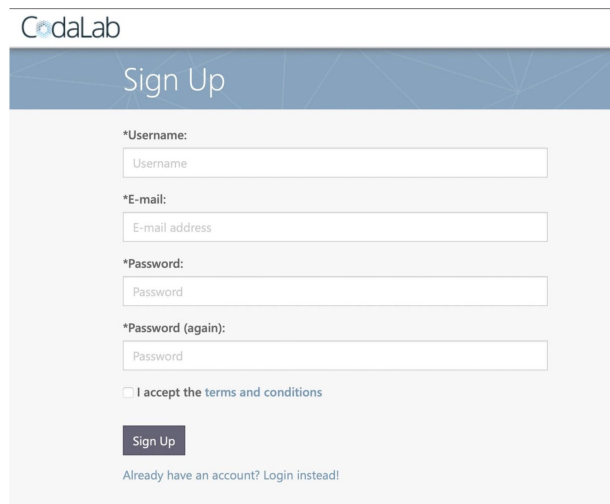
[] ↪ 1 cell hidden

▸ 3.4 My method of text processing

▶ ↪ 1 cell hidden

CodaLab (регистрация)

**Knowledge Graph Question Answering:
Multilingual Text Detoxification:**



The image shows the CodaLab registration page. At the top, the CodaLab logo is on the left, and a blue banner with the text "Sign Up" is on the right. Below the banner, the form is on a light gray background. It contains four input fields: "Username", "E-mail address", "Password", and "Password (again)". Each field is preceded by an asterisk and its label. Below the password fields is a checkbox labeled "I accept the terms and conditions". At the bottom of the form is a dark blue "Sign Up" button. Below the button is a link that says "Already have an account? Login instead!".

CodaLab

Sign Up

*Username:

*E-mail:

*Password:

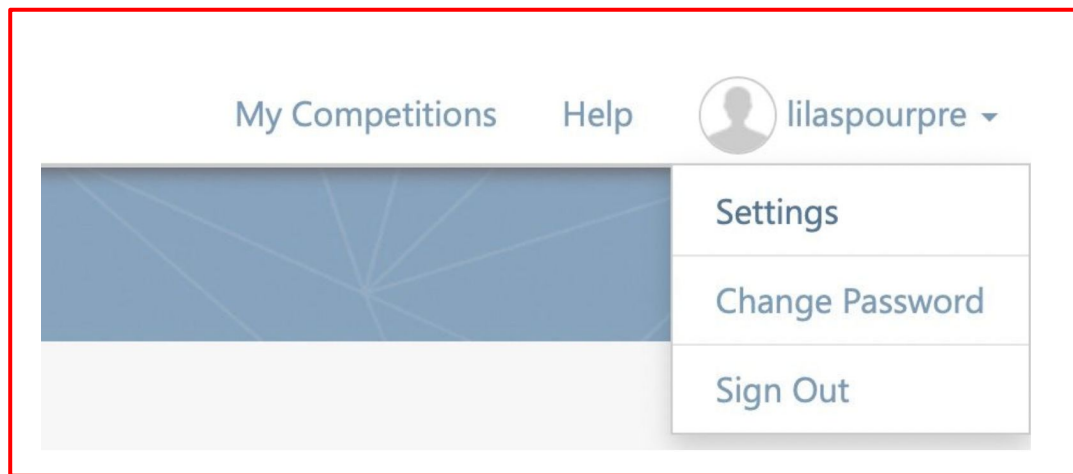
*Password (again):

☐ I accept the terms and conditions

[Sign Up](#)

[Already have an account? Login instead!](#)

CodaLab (необходимо указать имя команды)



Team name	Transformers-Spring24	Sber
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Отправка решения

Learn the Details Phases **Participate** Results

Get Data

Files

Submit / View Results

Development **Final test** **Post-evaluation**

Phase description

!!! Attention !!! You should submit a zip archive which contains a *.tsv file.

Max submissions per day: 999

Max submissions total: 999

Max Submission Size: 30 megabyte(s)

Click the Submit button to upload a new submission.

Optionally add more information about this submission

Submit

Here are your submissions to date (✓ indicates submission on leaderboard):

#	SCORE	FILENAME	SUBMISSION DATE	SIZE (BYTES)	STATUS	✓	
1	0.4179527963	test.zip	03/23/2022 09:39:01	137043	Finished	✓	+
2	---		03/31/2022 12:48:31		Submitting		-

No description given.

update description

Download your submission

View scoring output log

View scoring error log

View predict output log

Refresh status

Лидерборд

[Learn the Details](#)[Phases](#)[Participate](#)[Results](#)[Development](#)[Final test](#)[Post-evaluation](#)

Phase description

!!! Attention !!! You should submit a zip archive which contains a *.txt file with your detoxified sentences.

Max submissions per day: 999

Max submissions total: 100

[Download CSV](#)[Download all submissions on leaderboard](#)

Results									
#	User	Entries	Date of Last Entry	Team Name	Style transfer accuracy ▲	Meaning preservation ▲	Fluency ▲	Joint score ▲	ChrF1 ▲
1	gleb.shnshn	3	02/04/22		0.97 (3)	0.93 (1)	0.95 (4)	0.86 (1)	0.53 (13)
2	orzhan	24	01/25/22		0.98 (2)	0.83 (6)	0.95 (2)	0.78 (2)	0.55 (10)
3	Phoenix120	24	01/23/22	Mindful Squirrel	0.91 (7)	0.90 (2)	0.95 (1)	0.78 (3)	0.55 (8)
4	Rexhaif	1	01/03/22	FRC CSC RAS	0.93 (5)	0.83 (7)	0.95 (3)	0.73 (4)	0.57 (4)
5	aorews	1	02/08/22		0.94 (4)	0.79 (13)	0.85 (9)	0.66 (5)	0.52 (15)