



МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ
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ВЫПУСКНАЯ КВАЛИФИКАЦИОННАЯ РАБОТА БАКАЛАВРА

На тему: Построение системы генерации стилизованных текстов с использованием алгоритмов
искусственного интеллекта и нейронных сетей.

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РЕФЕРАТ

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ГЕНЕРАЦИЯ ТЕКСТА, НЕЙРОННЫЕ СЕТИ, NLP, TRANSFORMER,
ДООБУЧЕНИЕ, RUGPT-3

В работе представлено решение задачи дообучения языковой модели архитектуры Transformer для генерации стилизованного текста из заданной предметной области.

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ВВЕДЕНИЕ

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ОСНОВНАЯ ЧАСТЬ

1. Теоретическая часть

1.1 Начало

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$$E = mc^2 \tag{1.1}$$

ЗАКЛЮЧЕНИЕ

Приходим к выводу...

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СПИСОК ИСПОЛЬЗОВАННЫХ ИСТОЧНИКОВ

1. ru-gpts. — Режим доступа: <https://github.com/ai-forever/ru-gpts> (дата обращения: 17.04.2022).

ПРИЛОЖЕНИЕ А

ЛИСТИНГИ ИСХОДНОГО КОДА

Листинг А.1 — Графический интерфейс пользователя

```
1 import streamlit as st
2
3 from generate import load_tokenizer_and_model, generate, CACHE_DIR
4
5
6 def initialize() -> None:
7     """Initialize session state and set page config"""
8
9     st.set_page_config(
10         page_title="Autoplot AI",
11         page_icon="📊",
12         layout="wide",
13         initial_sidebar_state="collapsed"
14     )
15
16     if "model" not in st.session_state or "tokenizer" not in st.session_state:
17         with st.spinner("Loading model"):
18             tokenizer, model = load_tokenizer_and_model(CACHE_DIR)
19             st.session_state["tokenizer"] = tokenizer
20             st.session_state["model"] = model
21
22     if "text_versions" not in st.session_state:
23         st.session_state["text_versions"] = [""]
24
25
26 def main() -> None:
27     """User interface logic"""
28
29     text_versions = st.session_state["text_versions"]
30     tokenizer = st.session_state["tokenizer"]
31     model = st.session_state["model"]
32
33     button_cols = st.columns(3)
34     with button_cols[0]:
35         continue_btn = st.button("Дополнить")
36
37     with button_cols[1]:
38         undo_btn = st.button("Отменить")
39
40     with button_cols[2]:
41         st.download_button("Скачать результат", text_versions[-1], "result.txt")
```

```

42
43     text_container = st.empty()
44     text_area_attrs = {"label": "Текст", "height": 500}
45
46     with text_container:
47         working_text = st.text_area(value=text_versions[-1],
48                                     **text_area_attrs)
49
50     if continue_btn:
51         if len(working_text) == 0:
52             working_text = "Место действия — "
53
54         working_text = working_text[:-100] + generate(model, tokenizer,
55                                                         working_text[-100:])[0]
56
57         with text_container:
58             st.text_area(value=working_text, **text_area_attrs)
59
60     if text_versions[-1] != working_text:
61         text_versions.append(working_text)
62         st.experimental_rerun()
63
64     if undo_btn and len(text_versions) > 1:
65         text_versions.pop()
66         working_text = text_versions[-1]
67         with text_container:
68             st.text_area(value=working_text, **text_area_attrs)
69
70 if __name__ == "__main__":
71     initialize()
72     main()

```

Листинг A.2 — Модуль генерации текста

```

1  import time
2  import os
3  import sys
4  import random
5
6  from zipfile import ZipFile
7
8  import numpy as np
9  import torch
10
11 from transformers import GPT2LMHeadModel, GPT2Tokenizer
12

```

```

13
14 USE_CUDA = True
15 CACHE_DIR = os.path.join(os.getcwd(), "model_cache")
16 SEED = random.randint(0, 1000)
17
18 if not os.path.isdir(CACHE_DIR):
19     print("Extracting model...")
20     with ZipFile("model.zip") as f:
21         f.extractall(CACHE_DIR)
22
23 device = "cuda" if torch.cuda.is_available() and USE_CUDA else "cpu"
24
25 print(f"Running on {device}")
26
27
28 def load_tokenizer_and_model(model_name_or_path):
29     print("Loading tokenizer and model from " + CACHE_DIR)
30     tokenizer = GPT2Tokenizer.from_pretrained(model_name_or_path)
31     model = GPT2LMHeadModel.from_pretrained(model_name_or_path).to(device)
32     return tokenizer, model
33
34
35 def generate(
36     model, tok, text,
37     do_sample=True, max_length=50, repetition_penalty=5.0,
38     top_k=5, top_p=0.95, temperature=1,
39     num_beams=None,
40     no_repeat_ngram_size=3
41 ):
42     input_ids = tok.encode(text, return_tensors="pt").to(device)
43     out = model.generate(
44         input_ids.to(device),
45         max_length=max_length,
46         repetition_penalty=repetition_penalty,
47         do_sample=do_sample,
48         top_k=top_k, top_p=top_p, temperature=temperature,
49         num_beams=num_beams, no_repeat_ngram_size=no_repeat_ngram_size
50     )
51     return list(map(tok.decode, out))
52
53
54 def main(beginning):
55     np.random.seed(SEED)
56     torch.manual_seed(SEED)
57
58     tok, model = load_tokenizer_and_model(CACHE_DIR)

```

```

59
60     print("Generating")
61     prev_timestamp = time.time()
62     generated = generate(model, tok, beginning, max_length=200, top_p=0.95,
63                          temperature=0.7)
64     time_spent = time.time() - prev_timestamp
65
66     print(generated[0])
67
68     print(f"Elapsed time: {time_spent} s.")
69
70 if __name__ == "__main__":
71     main(sys.argv[1])

```

Листинг А.3 — Скрипт для валидации и обработки данных

```

1  import os
2  import re
3  import shutil
4
5  from collections import namedtuple
6  from sys import argv
7  from typing import List, Union
8
9
10 DATA_PATH = argv[1]
11 if DATA_PATH[-1] != "/":
12     DATA_PATH += "/"
13
14 OUT_PATH = "humanized"
15
16 Block = namedtuple("Block", ["tag", "content"])
17
18
19 def parse(text: str) -> List[Union[Block, str]]:
20
21     text = re.sub("<<", "<<", text)
22     text = re.sub(">>", ">>", text)
23     text = re.sub(r"\s+|\n", " ", text)
24     s = re.sub(r"(</?\w+>)", r"[CUT]\1[CUT]", text)
25     cut = list(filter(lambda t: len(t) > 0, map(str.strip, s.split("[CUT]"))))
26
27     open_tag_pat = re.compile(r"<\w+>")
28
29     cur_errors = []
30

```

```

31 def parse_list(l: List[str]) -> List[Union[Block, str]]:
32     it = iter(l)
33     out = []
34     while True:
35         try:
36             el = next(it)
37         except StopIteration:
38             break
39
40         if re.match(open_tag_pat, el):
41             tag = el[1:-1]
42             next_it = []
43             while not re.match(f"<W{tag}>", el):
44                 try:
45                     el = next(it)
46                 except StopIteration:
47                     # raise SyntaxError(f"<{tag}> was not closed:
48                     # {out[-1]}; {' '.join(next_it)}")
49                     cur_errors.append(f"<{tag}> was not closed: {out[-1]
50                     if len(out) > 0 else ''}; {' '.join(next_it)}")
51                     break
52                 else:
53                     next_it.append(el)
54             if len(next_it) > 0:
55                 out.append(Block(tag, parse_list(next_it[: -1])))
56         else:
57             out.append(el)
58
59     for e in out:
60         if isinstance(e, str) and re.match(r"</?.+>", e):
61             i = out.index(e)
62             cur_errors.append(f"Found tag in processed data: {e};
63             {out[max(i - 2, 0):i + 1]}")
64
65     return out
66
67 return parse_list(cut), cur_errors
68
69 cur_name = ""
70 def humanize(s: List[Union[Block, str]]) -> str:
71     sentences = []
72
73     global cur_name
74
75     for el in s:
76         if isinstance(el, str):

```

```

74         sentences.append(el.strip())
75     else:
76         if el.tag == "header":
77             continue
78         elif el.tag == "footer":
79             continue
80         elif el.tag == "remark":
81             sentences += ["\n" + "Ремарка —", humanize(el.content)]
82         elif el.tag == "author":
83             sentences += ["\n" + "Слова автора —", humanize(el.content)]
84         elif el.tag == "title":
85             sentences += ["\n\n" + "Заголовок —", humanize(el.content),
86                           "\n"]
87         elif el.tag == "place":
88             sentences += ["\n" + "Место действия —",
89                           humanize(el.content).strip(".") + "."]
90         elif el.tag == "time":
91             sentences += ["\n" + "Время действия —",
92                           humanize(el.content).strip(".").lower() + "."]
93         elif el.tag == "chars":
94             sentences += ["\n" + "Действующие лица —",
95                           humanize(el.content).strip(".") + "."]
96         elif el.tag == "name":
97             cur_name = humanize(el.content).strip().capitalize()
98         elif el.tag == "line":
99             sentences += ["\n" + cur_name, "говорит:", "«" +
100                           humanize(el.content).strip(".") + "»"]
101         elif el.tag == "how":
102             sentences.append(humanize(el.content).lower())
103
104     sentences = filter(lambda t: not re.match(r"^\W*$", t) or t == "\n",
105                       sentences)
106     sentences = " ".join(sentences)
107     if sentences[0] == "\n":
108         sentences = sentences[1:]
109     return sentences
110
111 if __name__ == "__main__":
112     paths = []
113     for root, _, files in os.walk(DATA_PATH):
114         for file in files:
115             paths.append(os.path.join(root, file))
116
117     parsed = []
118     errors = []

```

```

114     for path in paths:
115         with open(path) as file:
116             try:
117                 content = file.read()
118             except Exception as e:
119                 print(e, path)
120                 raise
121
122         try:
123             t, e = parse(content)
124             if len(e) > 0:
125                 raise SyntaxError("\n\n\n".join(e))
126             parsed.append((path, t))
127         except SyntaxError as e:
128             errors.append((path, e))
129             continue
130
131     print(f"Errors occurred in {len(errors)} files")
132     print(f"Successfully parsed {len(parsed)} files")
133
134     if os.path.isdir(os.path.join("errors", "data")):
135         for f in os.listdir(os.path.join("errors", "data")):
136             os.remove(os.path.join(os.path.join("errors", "data"), f))
137     for p, e in errors:
138         os.makedirs(os.path.join("errors", "data"), exist_ok=True)
139         path = os.path.join("errors", "data", os.path.split(p)[-1])
140         with open(path + ".log", "w") as f:
141             f.write(str(e))
142
143         os.system(f"cp '{p}' '{path}'")
144         # break
145
146     if os.path.isdir(OUT_PATH):
147         for f in os.listdir(OUT_PATH):
148             os.remove(os.path.join(OUT_PATH, f))
149     os.makedirs(OUT_PATH, exist_ok=True)
150
151     for i, (path, script) in enumerate(parsed):
152         text = humanize(script)
153
154         new_path = os.path.join(OUT_PATH, re.sub(DATA_PATH, "", path))
155         os.makedirs(os.path.split(new_path)[0], exist_ok=True)
156         with open(new_path, "w") as f:
157             f.write(text)
158
159     if os.path.isdir("invalid_files"):

```

```
160         for f in os.listdir("invalid_files"):
161             os.remove(os.path.join("invalid_files", f))
162     for path, _ in errors:
163         os.makedirs("invalid_files", exist_ok=True)
164         shutil.copy(path, "invalid_files")
```