

An LLM-Powered Tool for Enhancing Scientific Open-Source Repositories

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Introduction

To reduce the amount of routine work involved in preparing scientific repositories, we propose an open-source tool that leverages large language model (LLM) agents to enhance the preparation process and achieve more intuitive and user-friendly experience for reproducible research.

Key features

- Preparation of basic documentation for existing code (README, docstrings).
- Analysis of the compliance of existing repository with best practices.
- Improvement of the structure and configuration of CI/CD pipelines in repository.
- Integrated automatic scheduler operated in 3 modes: basic, automatic, and advanced.
- Automation of translation of text and file names and READMEs for non-English language repositories.

System pipeline

The **Analytics Tool** analyzes code and structure of a repository, builds report.

The **Documentation Tool** generates README, docstrings, translates to EN.

The **Repository Tool** produces CI/CD scripts, generates tags and short description, automates Git operations.

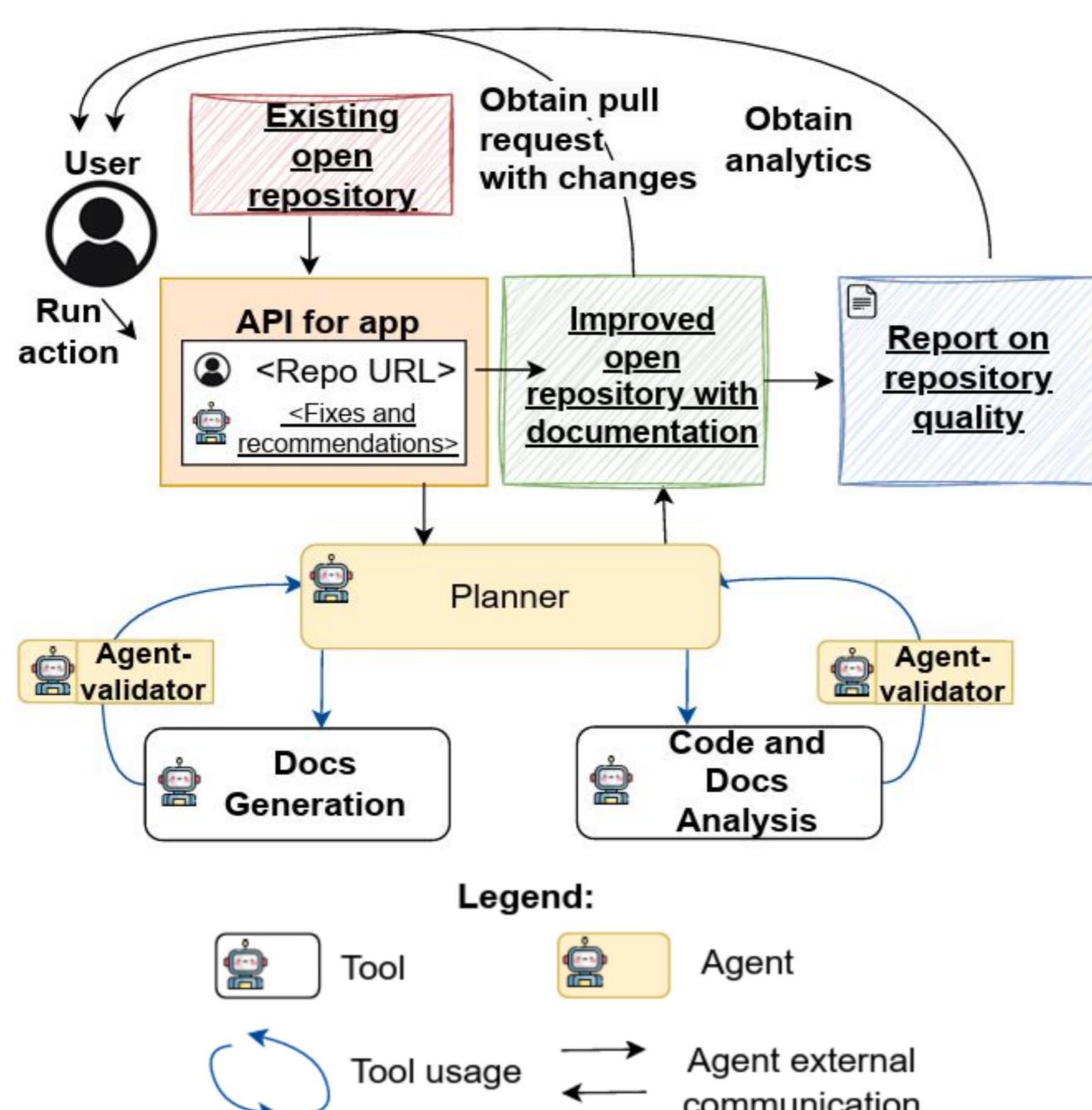


Figure 1. Architecture of OSA with description of main agents and tools.

Advantages

- Fully open-source with community-driven development.
- Highly configurable CLI tool and Web-based interface.
- Integration with diverse LLM providers.
- Supports GitHub, GitLab and Gitverse.

Experimental studies

Table 1. G-Eval metrics for OSA against LLM-based baseline and ReadmeAI.

Repository type	LLM Type						
	GPT 4.1		Claude Sonnet 4		Gemma-3-27b ¹		
LLM baseline	Readme AI ²	OSA	LLM baseline	OSA	LLM baseline	OSA	
General	0.31	0.72	0.76	0.17	0.79	0.35	0.75
Scientific	0.40	0.77	0.80	0.33	0.82	0.23	0.78

¹Performance metrics for DeepSeek-V3 and Gemini 2.5 Flash are comparable to Gemma-3-27B.

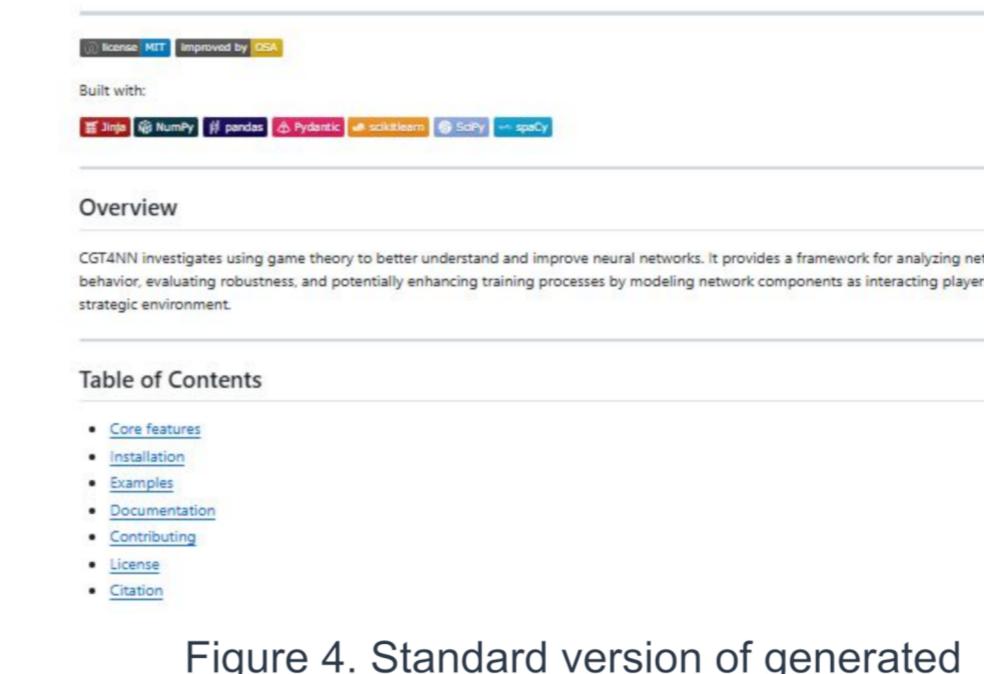
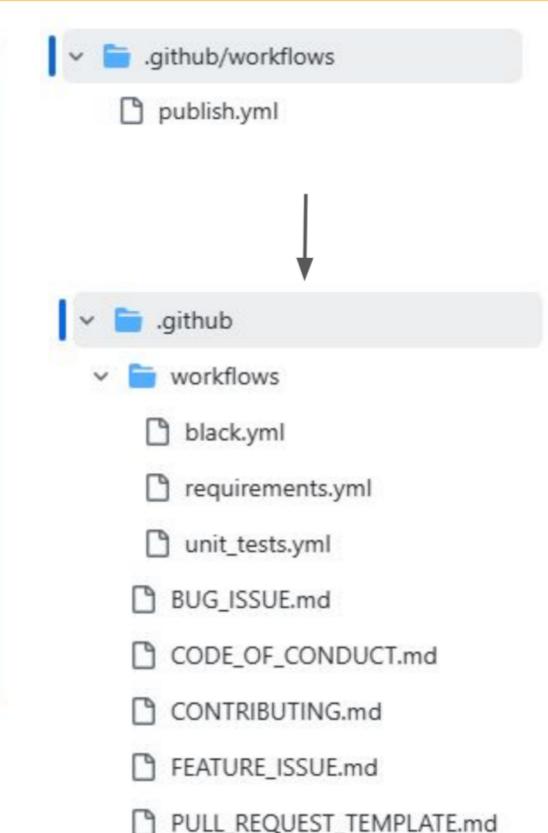
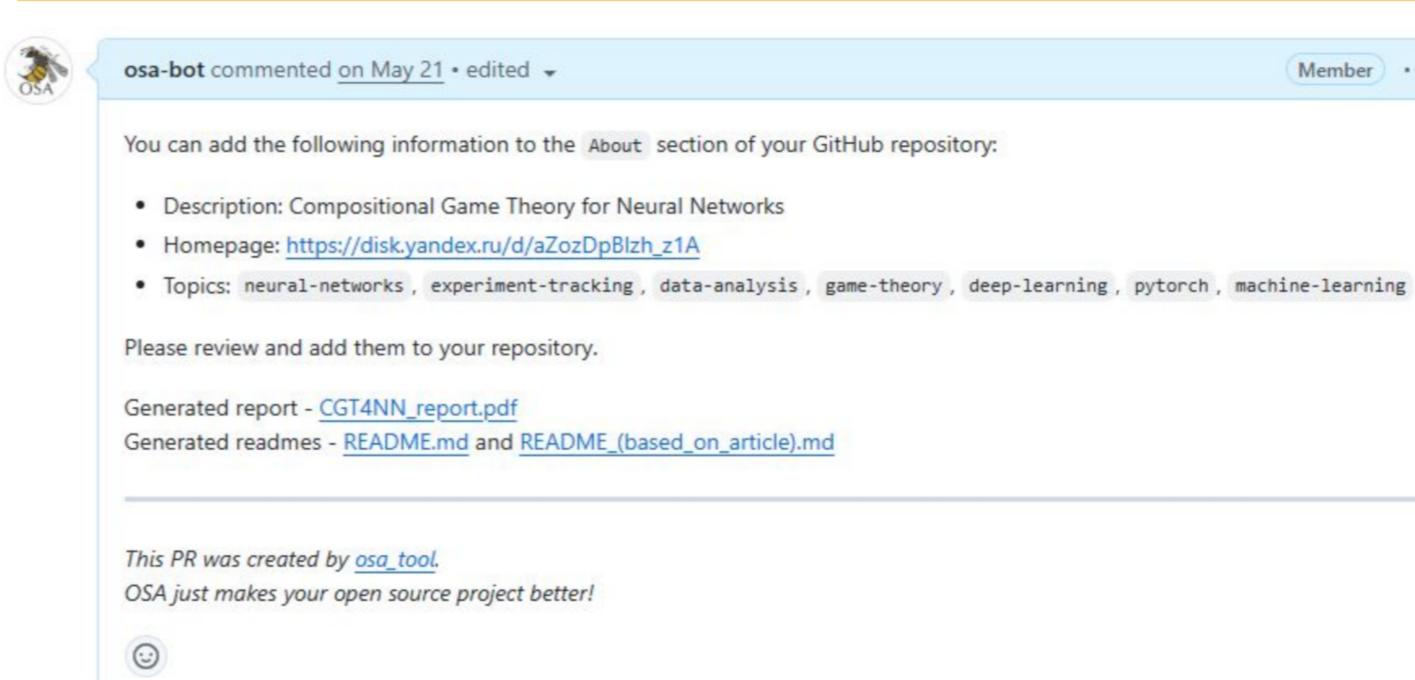
²The comparison with ReadMeAI was conducted using the GPT-4.1 model developed by OpenAI.

Table 2. Comparison of OSA and RepoAgent across metrics (BERT score, Flesch readability, Conciseness, processing time in minutes) for different repositories.

Project	BERT ↑		Readab. ↓		Concise. ↓		Time, m ↓	
	OSA	RA	OSA	RA	OSA	RA	OSA	RA
aider	0.77	0.64	42.85	45.11	2.03	8.02	15	56
flask	0.65	0.60	43.87	45.08	1.80	5.13	16	28
requests	0.65	0.66	47.42	50.68	2.34	5.92	8	14
seaborn	0.66	0.54	40.93	49.88	2.76	9.74	30	87
cryptography-suite	0.67	0.49	39.84	42.02	2.94	11.27	28	57
Dottore-....-Simulator	0.65	0.48	42.69	42.37	2.67	11.73	145	482
labrea	0.69	0.57	38.38	40.17	1.99	6.81	23	39
petptx	0.74	0.52	46.08	46.05	1.86	8.61	90	488
pytube2	0.63	0.51	45.75	46.43	2.18	8.22	12	24
ghg	0.61	0.61	26.28	51.32	3.31	9.47	6	10
mongorunway	0.66	0.61	31.53	36.03	1.53	4.18	10	11
pygithubactions	0.70	0.53	40.51	44.11	1.91	7.22	20	23
vectorspace	0.64	0.50	45.89	47.96	2.97	10.85	9	9
yamlator	0.83	0.64	42.56	41.34	1.60	6.54	4	2
Total							416	1330

OSA produces README files with **higher quality** than pure-LLM solutions and ReadmeAi and generates docstrings **better** than RepoAgent.

Example



```
def stable_noise_func(alpha, beta, size=1):  
    """  
    Generates stable noise samples using the Chambers-Hallows-Stuck (CHS) algorithm.  
  
    Args:  
        alpha: Stability parameter (0 < alpha <= 2). alpha=2 corresponds to Gaussian. alpha=1 Cauchy.  
        beta: Skewness parameter (-1 < beta < 1). beta=0 is symmetric.  
        size: Number of samples to generate.  
  
    Returns:  
        A numpy array of stable noise samples.  
  
    Raises:  
        ValueError: If alpha or beta are outside the allowed ranges.  
    """
```

Figure 5. Generated docstrings.

Future works

In future we would like to add a **RAG system** to OSA based on our repository with the best practices of open source design. It is assumed that by comparing with the sample, OSA will determine what exactly is missing from the repository being checked. Also we plan to expand the list of supported languages (now we focused on Python).



OSA



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