COSMOS: An AI platform for knowledge discovery and scientific model curation

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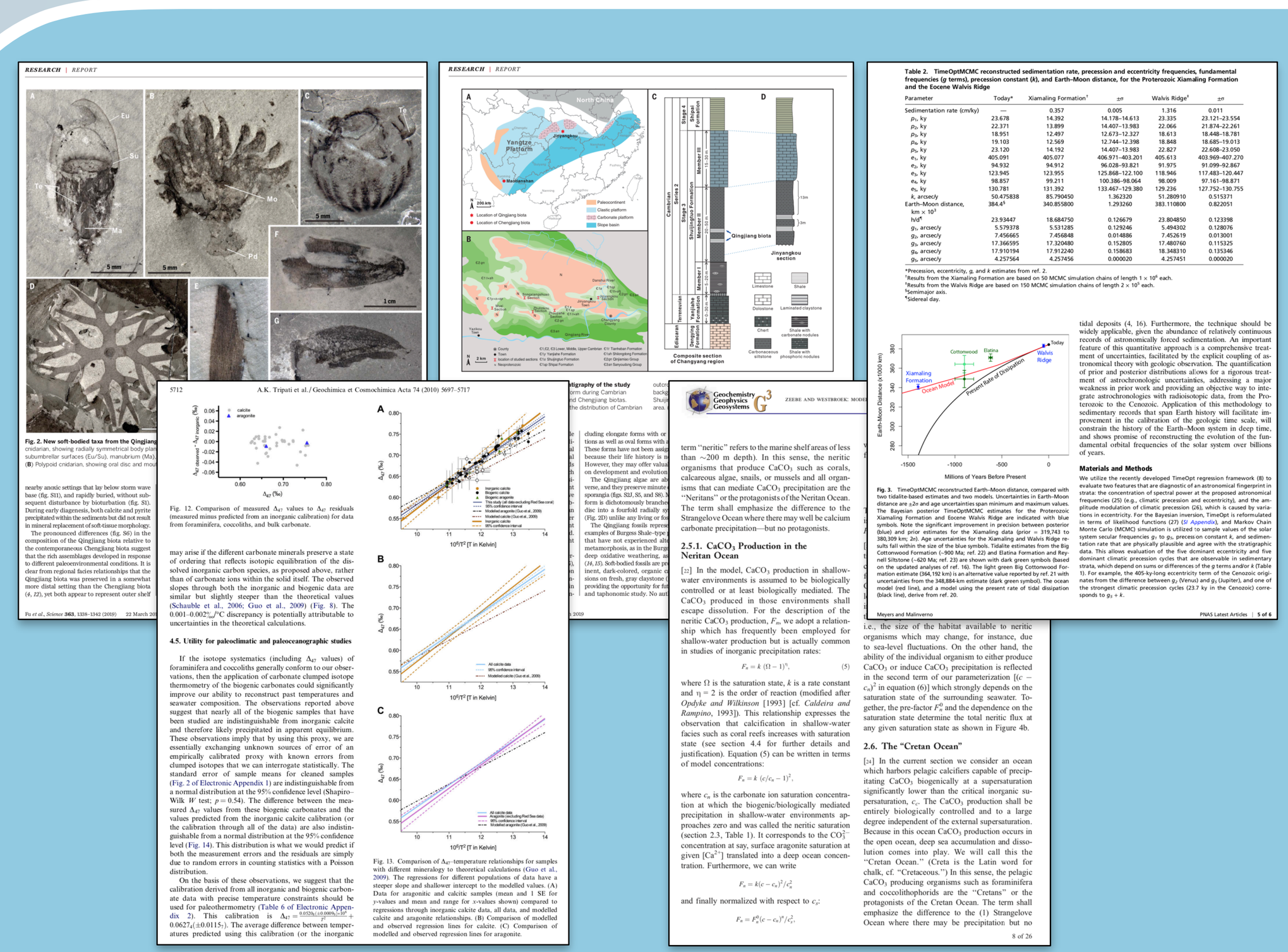
Goal: Develop an AI technical assistant capable of assimilating knowledge and data relevant to scientific models from across millions of publications.

Problem Overview



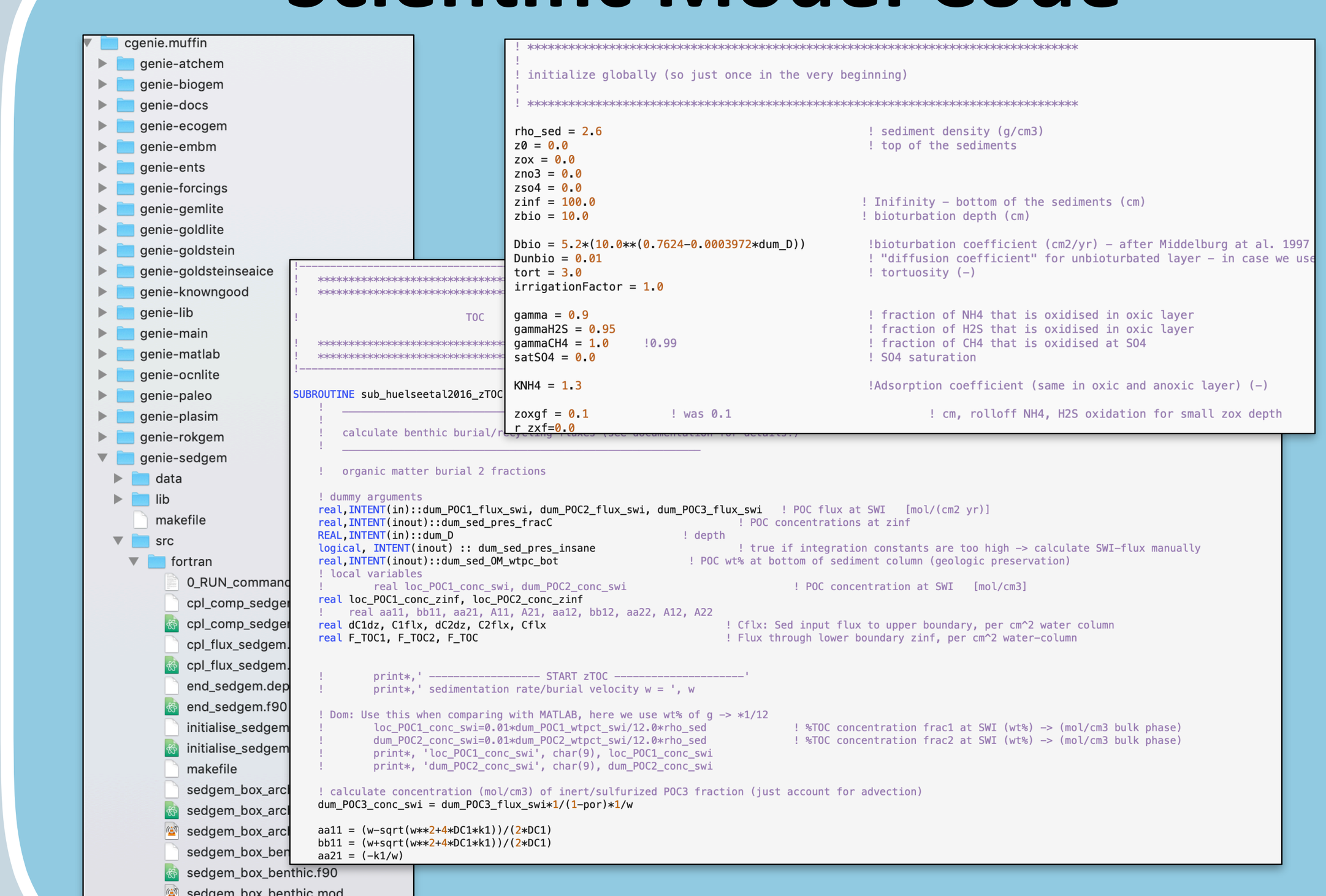
Scientific Literature

Scientific publications encapsulate technical knowledge and contain data and descriptions of phenomena necessary to parameterize and evaluate models. Using the published literature in the construction and assessment of models is challenging due to:

- Vast and rapidly growing number of publications distributed by multiple sources
- Heterogeneity of document formats and publication conventions
- Disparate representations of information
- Uncertainty and conflicting information

Need an AI technical assistant to automate integration and analysis

Scientific Model Code



Much of the world's scientific knowledge is most explicitly encapsulated in model codes. Understanding models, re-calibrating them to observational or experimental data, and evaluating model output is often challenging due to:

- Large, complex, code bases with sparse, heterogeneous documentation
- Need to map model parameters and output to diverse representations in scientific publications
- Difficulty of identifying related phenomena not captured by model
- Uncertainty in model-data comparisons

Solution Overview

- User-focused
- Answer questions, generate synthesis results
- Interactive evaluation and AI model training

- Extraction of sci. models, entity relations across tables, figures, equations
- Knowledge discovery across millions of papers

- Fine-tuned ML models over unified contextual representation to support diverse tasks
- Continual updating

Retrieve-and-Read Q&A	On-demand Knowledge Bases	Model Evaluation	Dataset Generation

COSMOS Microservices API

COSMOS Microservices	Automated container deployment, scaling, and management using Docker swarm; open source	service-oriented
COSMOS Ingestion Layer	Deep Learning models for document analysis and recognition. Granular information extraction from tables, figures, text, and mathematical expressions.	COSMOS Universal Entity Representation
High Throughput Computing Layer	HTCondor High Throughput Computing; GPU, CPU nodes DAGman job queue encrypted binaries	XML; parsed and annotated documents, databases
Digital Library Layer (xDD)	Automated ingestion of full publications from multiple publishers, backed by institutional agreements: **10.6M documents, +10K daily**	secure storage, backup, metadata, text indexes