The International Mathematical Union (#IMU) strongly supports the establishment of a Global Digital Mathematics Library (GDML). It realizes that mathematicians can either continue to utilize digital literature in ways similar to traditional printed literature, or can profit from emerging technology to advance knowledge.

In 2012, CEIC organized the International Symposium on The Future World Heritage Digital Mathematics Library. The conclusions of the meeting explore practical mechanisms, challenges, and capabilities required for the realization of the GDML [1].

During the International Congress of Mathematicians in 2014 (#ICM2014), the newly established GDML WG, chaired by Patrick Ion, and under the sponsorship of the IMU, was charged with designing a roadmap towards the GDML, determining its organisational structure, prioritizing requirements for its implementation, estimating a budget, including start-up and sustaining funds, and fostering the writing of proposals to funding agencies. The panel discussion, that was begun during ICM2014, now continues on the newly established GDML blog [2].

The GDML

The vision for the GDML is that of a growing corpus of public-domain and openly licensed mathematical information, Web services, and software agents, cooperating with present mathematical publishing and indexing services. Imagine being able to search the literature for instances where a specific list of math was used or solved; it would allow you to consider alternative approaches toward solving your own research questions. This type of search capability could be facilitated through the use of a database of machine-generated and human-cultivated information about the mathematical literature and allow for a variety of other capabilities to be built.

Today we have the opportunity to expand and redefine the way in which mathematical knowledge is represented and used, the character of mathematical literature and how it evolves, and empower mathematicians by new possibilities of interacting with knowledge. This future relationship with the literature and the mathematical knowledge corpus will go beyond new forms of access and analytical tools; it will also include tools and services to accommodate the creation, sharing, and curation of new kinds of knowledge structures.

Which mathematical data?

Important data for the working mathematician, and in general for the scientist, is previous knowledge. Digitization efforts for mathematical knowledge have been undertaken in the last decades with the European Digital Mathematics Library, EuDML, and the National Science Digital Library, NSDL, being prominent examples of metadata-driven centralised services. The current digital corpus of bibliographic information for mathematical literature is extensive:

- MathSciNet (1940-present) holds over 3 million items and indexes over 2000 journals.
- Zentralblatt,zbMATH (1868-present, incl. Jahrbuch), contains more than 3 million entries and currently indexes more than 3000 journals and serials.

Looking at the increase in mathematical papers added over the past 5 years to arXiv, it seems that more and more mathematical literature will be in digital form, some with high-quality markup, specifically those “born” digital or retro-digitized to be in a machine readable format such as MathML or MathML. Lists and tables have always been essential for the working mathematician. The most basic are numerical tables (e.g., values of logarithms, trigonometric functions, special functions, zeros of the zeta function, integer sequences). More sophisticated are lists of mathematical objects (e.g., indefinite and definite integrals, finite simple groups, Fourier transforms, partial differential equations and their solutions), or even lists of definitions, axioms, and theorems.

Example digital collections include:

- LOCOMAT, the LORIA Collection of Mathematical Tables is a library of recomputed historical tables.
- NIST Digital Library of Mathematical Functions (DLMF), a digital revision of Abramowitz and Stegun’s Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables, likely the most widely distributed NBS/NIST technical publication of all time.
- On-Line Encyclopedia of Integer Sequences (OEIS) celebrating 50 years of identifying sequences and still receiving over 100 new sequences and updates per day, all handled by volunteer editors.
- Wolfram Functions Site, the world’s most encyclopedic collection of information about mathematical functions.

Future perspectives

Expanding the range of computer software that is math-aware will enable moving from text mining to math mining. This work will cover aspects of classification and representation of mathematical knowledge, computational linguistics, aggregation and analysis of corpora, tools for metadata and full-text processing, ontology and document analysis, information retrieval developments, and document processing workflows. The needs of large user communities will drive this process towards the goals of the GDML and this will eventually improve access for all.

References