

“AI in Focus: Artificial Intelligence and Libraries” Conference

IFLA IT Section Mid-term Satellite Conference
Singapore, Singapore

Patrick Cher, patrick_cher@nlb.gov.sg
Project Manager, Technology and Services Group
National Library Board, Singapore

Introduction



Fig. 1 – National Library Building in Singapore.

A conference co-organised by the IFLA Information Technology (IT) Section, the Big Data Special Interest Group, the Artificial Intelligence Special Interest Group and the National Library Board (NLB), Singapore took place at the National Library Building on March 2 and 3, 2023. As part of the two-day hybrid conference, participants discussed AI's practical implementation, upcoming opportunities and future ethical considerations.

Pre-conference Library Tour of Robotics and Automation Solutions

The conference started on a high note, with a pre-conference library tour to the Tampines Regional Library on 1 March 2023. The tour gave delegates a first-hand view of the various robotics and automation solutions deployed for library operations, including the Mobile

Bookdrop and Shelf-Reading Robot. These solutions were part of the NLB's 5-year Libraries of the Future masterplan to transform library services and operations to serve users better. Guided by the smart operation roadmap, robotics and automation were introduced to reduce mundane and routine work, so that library staff could focus on higher value work.

Mobile Bookdrop

Due to its enormous physical space spanning 10,900 square metres, over five storeys, the Tampines Regional Library showcased robotics and automation to exemplary effect. Mobile Bookdrop was developed in response to library users' frustrations with finding stationary book drop stations far away from the main entrance. Mobile Bookdrop robots follow marked lines in the library with a bin attached. A bin can hold up to 150 books before replacement.



Fig. 2 – Mobile Bookdrop robot stopping for 2 library users at the Tampines Regional Library.

Auto Sorter

The Auto Sorter is a conveyor belt system that processes books returned at the bookdrop and sorts the returned items by detecting the RFID tag into bins based on pre-defined categories. Manual intervention was required for exception items, which makes up 1% of the returned items. Once the bins are filled, staff are alerted to transfer books to trolleys for shelving. Using analysis of past loan records, the Auto Sorter identified popular items for staff to put up on the "Just Returned" shelves near the library entrance.



Fig. 3 – Children observing the Autosorter in the library@harbourfront.

Shelf-Reading Robot

The Shelf-Reading Robot is a robot that tackles the problem of erroneously placed books and reduces the number of man hours needed for those corrections. The robot detects RFID tags in the library books on the shelves, ensuring that they are in the right place and order, with 99% accuracy. The robot would produce a report detailing the misplaced books and their locations, so staff could replace them. With the robot, shelf-reading is performed twice a day, so that there are up-to-date records to enable users to search for the location of a book on the shelf. Data on the items' locations were collected from the scans and fed into the library catalogue system. This enabled library users to locate books via the library map in the catalogue and NLB Mobile app.



Fig. 4 – Shelf Reading Robot in action of scanning shelves with its multiple arms.

Conference Retrospective

The conference presented informative and thought-provoking sessions, featuring esteemed speakers from organizations such as the National Institute of Education Singapore, Library of Congress, National Library of Australia, and Hong Kong SKH Ming Hua Theological College. Topics covered a wide range of areas, including AI-powered Library Innovations, AI-driven data analysis, AI in digital preservation, and the use of mini-AI games for Digital Humanities.



Fig. 5 – Dr Ramine Tinati giving the opening keynote.

The conference commenced with a welcome address by the chairperson of the IFLA IT Section, Dr Edmund Balnaves, followed by an opening keynote by Dr Ramine Tinati, Managing Director and ASEAN Chief Data Scientist at Accenture. Dr Tinati provided an overview of the landscape of AI and ML, discussing the current state of AI and advancements. He concluded his keynote by sharing a few industrial applications of AI, such as a toolkit that enables financial institutions to document bias in their AI models and a graph-based search engine and recommender that offers users a new experience to find library items in the physical and digital catalogue. This set the stage for the mid-term conference.

Jacky Wong and Feng Yikang: Using Crowd Data to Create New User Experiences: Incorporating Robotic Process Automation, Geovisualisation and Service Robot

Jacky and Yikang presented information on the Robotic Process Automation (RPA), Geovisualisation and Service Robot projects undertaken by the National Institute of Education Singapore (NIE) in response to the local government's safe distancing and crowd control measures.

The NIE team developed an innovative approach using Wi-Fi usage data from various wireless access points in the library as a proxy for crowd level. An RPA program was created to extract and compute this data to provide up-to-date information to staff and users. The data is accessible via an Application Programming Interface (API) that serves as an intermediary for different applications to communicate with each other.

The crowd data is displayed as a mobile responsive heatmap, which users can access through the library portal. This feature allows users to make informed decisions regarding their library visits and find less crowded spaces. TEMI, a roving service concierge robot, is also able to utilize the crowd level data to patrol crowded areas and broadcast Safe Management Measures announcements such as maintaining social distance and wearing masks.

Is the Library Crowded Now?

Occupancy Levels
20th September 2022, 1:41 pm

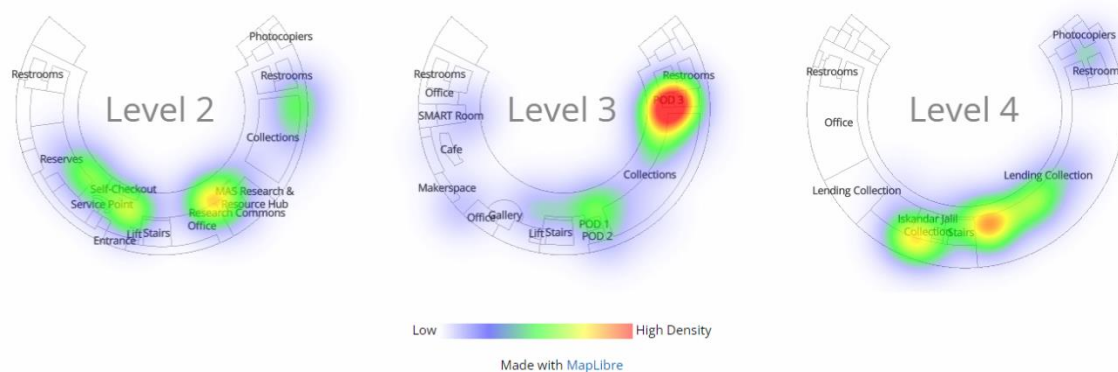


Fig. 6 – National Institute of Education’s Heatmap showing where the crowd is.

Dr Helen Cheung and Yoko Hirose Nagao: Development of Mini-AI Games with Digital Humanities for Library User Education

Dr. Helen delivered a presentation on the project titled "Connect the World via Libraries" undertaken by Hong Kong SKH Ming Hua Theological College, aimed at facilitating the development of digital literacy skills amongst librarians, faculties and students from Hong Kong, Japan and Australia. The programme involves various activities such as online tours, talks and mini-AI games, with the objective of helping students acquire coding and digital literacy skills and creating teaching materials for librarians and faculties.

The mini-AI games employed block-based programming languages such as Scratch, mBlock and MIT App Inventor, designed to provide participants with little or no coding skills an introduction to basic programming concepts. This served as a foundation for participants to progress towards text-based programming languages.

Given that the theological college is primarily focused on humanities, the games developed by the participants were centred around this area. Some initial games included features like identifying books by facial expressions, learning Japanese vocabulary via a shooting game and finding seals via Chinese characters.

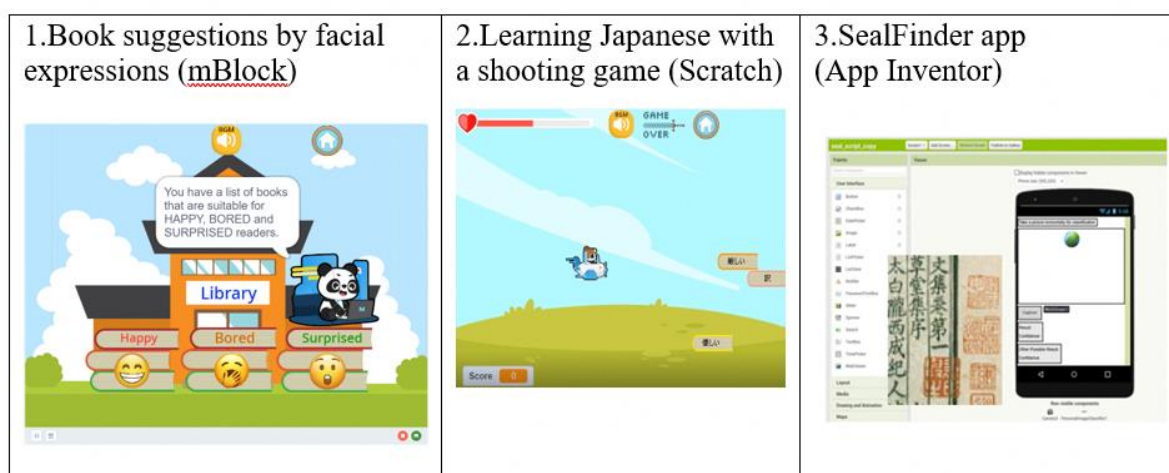


Fig. 7 – Mini-AI games developed by participants in August 2022.

Caroline Saccucci and Meghan Ferriter: Exploring Computational Description While Assessing Machine Learning

Caroline and Meghan, from the Library of Congress (LOC), presented an experiment to test five Machine Learning models in their ability to generate MARC record catalogue metadata from the contents of eBooks. The training data which the five ML models was trained on, consisted of 23,130 items and their existing catalogue records. A mix of text extraction and visual analysis approaches were tested on these five ML models – GROBID (GeneRation Of Bibliographic Data), Annif, LoC Spacy, BERT and NLP with Layout features.

The process of evaluation would help develop quality benchmarks for automated methods along with detailed benefits, risks, and costs. The outcomes of the experiment could help inform future developments in born-digital cataloguing workflows. A set of tools developed

by the LC Labs team will be used to plan, document, analyse, prioritize, and assess AI technologies.

David Wong and Cathy Pilgrim: The National Library of Australia and AI- The Use of Machine Learning and Complex Search Algorithms for the Australian Web Archive, Plans For AI, and Considerations for its Use

Since the 1990s, the National Library of Australia (NLA) has been successful in operating digital library services through content digitisation for online access. The presentation by David and Cathy delved into the NLA's progress beyond digitisation, measures taken thus far, as well as artificial intelligence and machine learning scaling and automating operations to remain relevant in a digital age.

The Australian Web Archive (AWA) contains snapshots of .au websites from 1996, some of which were believed to have disappeared, but are still available in the archive in full colour. Users could perform full-text searches in the archive, which is one of the world's largest openly searchable archives of web content that has been fully indexed. The NLA's version of Google's PageRank algorithm was employed as well as AI in indexing and search functionality to suppress unwanted noise and junk and providing users with the results they expect or desire.

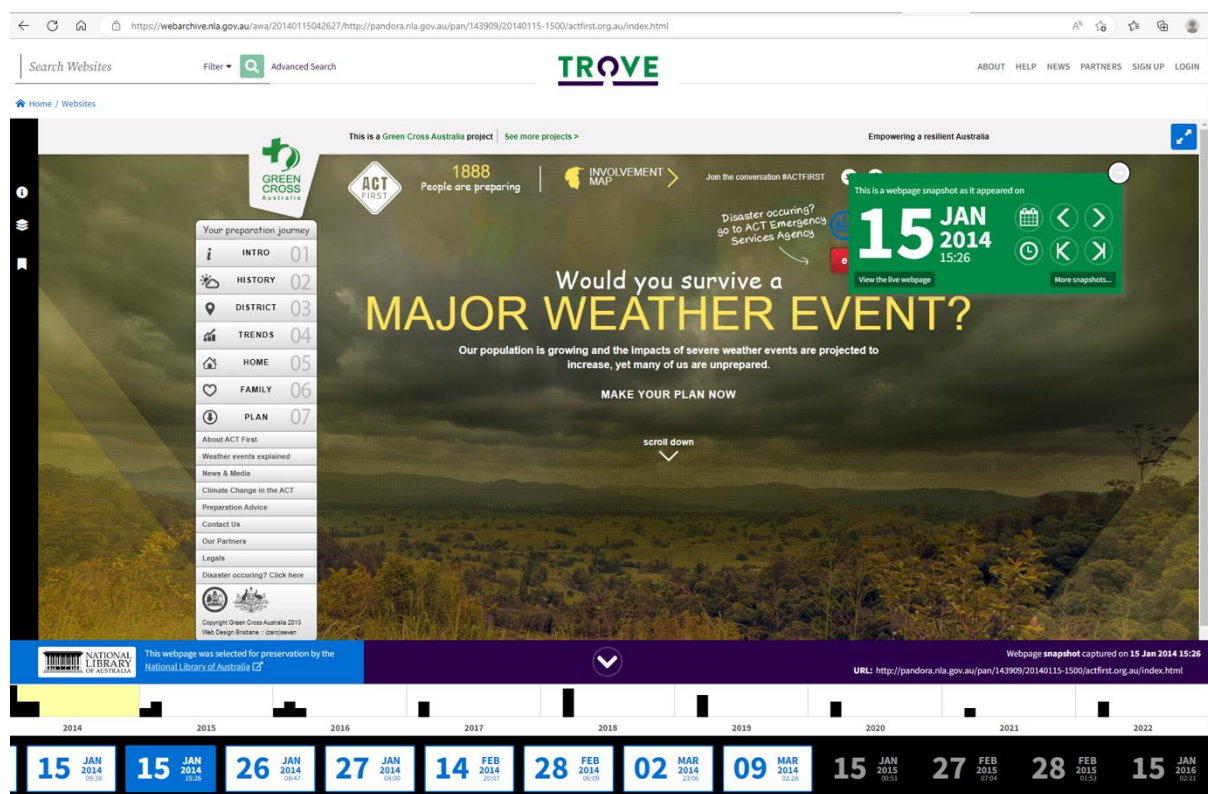


Fig. 8 – Screenshot of the Australian Web Archive.

The presentation also covered the AWA's page ranking algorithm, Bayesian filtering, and machine learning image recognition used to identify and classify essential content for an archive comprising 700 terabytes of data across 15 billion objects.

Conference Workshops

The attendees were provided with the opportunity to participate in workshops on Ethics and AI, as well as exploring Chatbots, Recommender Engines and Image Recognition across both days.

In the Ethics and AI workshop, participants were facilitated by Dr Andrew Cox, where they had the chance to work in groups to create ethics scenarios to generate awareness and discussion around AI and its ethics.

Dr Edmund Balnaves and Iman Magdy Khamis facilitated the Exploring Chatbots, Recommender Engines and Image Recognition workshop, which provided hands-on experiences and insights. The attendees were taught how to start their own projects using open-source toolkits, start their AI projects on \$5/day and build their first book Python recommender system.



Fig. 9 – Ethics and AI workshop facilitated by Dr Andrew Cox.

Concluding Thoughts

In conclusion, the International Federation of Library Associations' conference "AI in Focus: Artificial Intelligence and Libraries" was a great success. The conference brought together experts from around the world to discuss the practical implementation of AI in libraries, its ethical considerations, and opportunities. Attendees were treated to informative and thought-provoking sessions, and workshops on Ethics and AI, Chatbots, Recommender Engines, and Image Recognition. The pre-conference library tour to the Tampines Regional Library showcased robotics and automation in library operations, which has improved efficiency, reduced human error, and lowered operation costs. The adoption of these technologies has also allowed library staff to focus on higher value work.

Overall, the conference was a fantastic opportunity for attendees to develop collaborative relationships, learn and share ideas on how AI can be leveraged to improve library services and user experience. I would like to express our sincere gratitude to our esteemed colleagues from the National Library Board Singapore, IFLA IT Section, Artificial Intelligence Special Interest Group, Big Data Special Group, speakers, attendees, and all those who have contributed to the success of this conference. I eagerly anticipate future opportunities for collaboration and further discussions on AI and libraries.