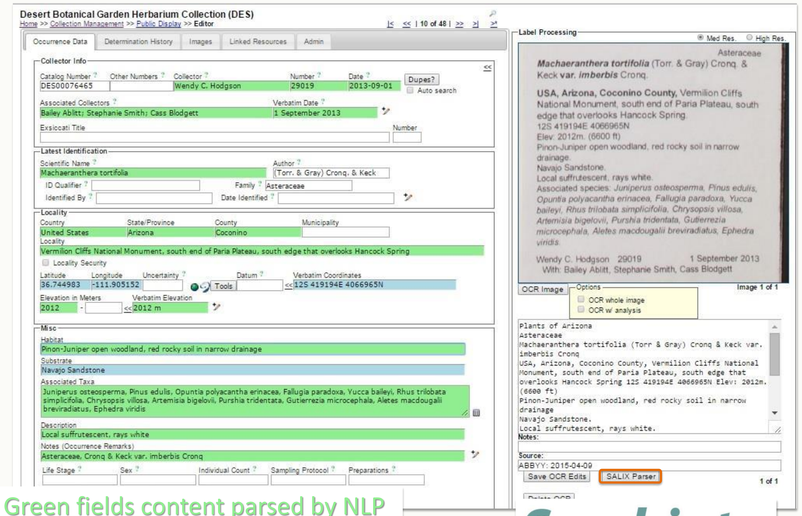
Natural Language Processing (NLP) and Machine Learning (ML): *Speeding Up Digitization* and *Increasing Doer Happiness*

Worldwide Examples

Across the planet, groups are working on ways to redesign and optimize current digitization methods – with the goal of achieving industrial scale rates. International collaboration is making it possible to discover and coordinate sharing of skills, software, and emerging new methods.



Green fields content parsed by NLP

Blue fields via duplicate record matching

Symbiota

General Symbiota Workflow with NLP and ML

A. Images are batch loaded and linked to a new blank record that is only populated with the catalog number obtained from the image file name,

B. The new record is augmented with **skeletal data** that was obtained during the image process and uploaded as a CSV file. Skeletal data typically consists of filed-by scientific name, country, and state, but may include collector, number, date, etc.

C. Automated batch OCR extracts text from the images and stores it in the database linked to the image.
   A. ABBYY OCR engine is typically preferred, but Tesseract can work depending on the font and condition of the label,

D. The data processor uses **the OCR parsers** integrated into the data entry form to extract content and insert it into the proper DwC fields.
   A. The lichen and bryophyte portals use the LBCC parser,
   B. The plant portals use the SALIX parser.

E. Both the LBCC and SALIX parsers are distributed with the Symbiota software and can be activated via the Symbiota configuration file.
   A. The SALIX parser is unique in that it uses word frequency tables to determine which fields, the label content belongs. As specimen records are processed, the frequency tables are augmented, which results in improved label parsing.

Machine Learning

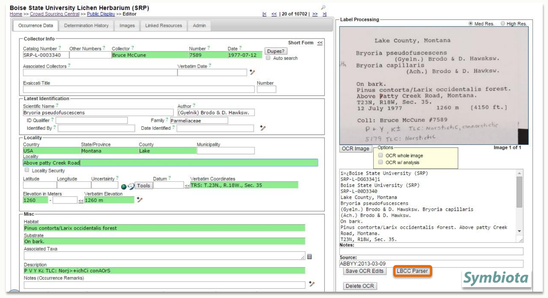
SYNTHESYS 3

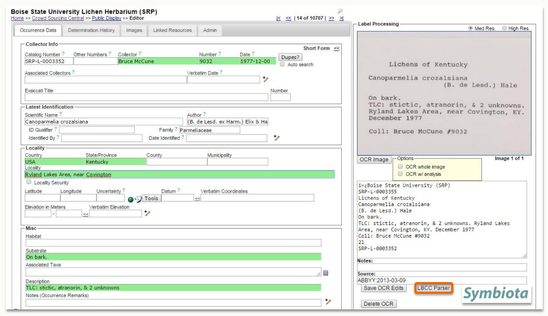
Synthesis of systematic resources

9 institutes: BGBM, MfN, MNHN, MRAC, NHM, NMP, RBGE & RBGK reviewing existing OCR software trials, like those by the iDigBio AOCR working group, and studying automatic metadata tools and workflows. Together they've designed an additional trial comparing 6 OCR software programmes.

- ❑ OCR processing on images provided by 6 partner institutes as well as a set from several US institutes supplied by iDigBio.
  - ❑ Images include *plants, insects, molluscs, and fossils*.
- ❑ Best OCR results so far:
  - ❑ A *server-based* option (ABBYY Recognition Server v3)
  - ❑ A *PC option* (ABBYY FineReader v12 Professional).
  - ❑ Two *online service options* (Onlineocr.net and Newocr.com) were the best of the online services but did not perform as well as the ABBYY software.
- ❑ OCR 100% correct compared to hand transcriptions in some cases.

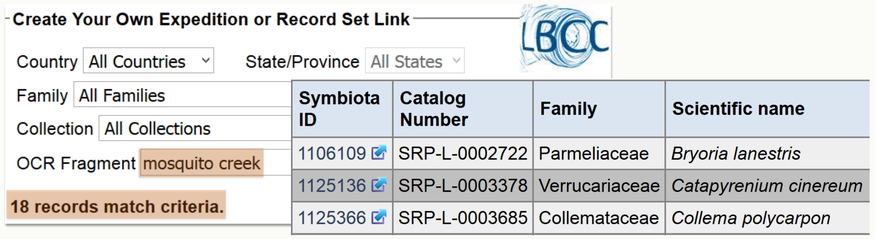
Via contacts made through the AOCR WG, the SYNTHESYS3 institutes have plans in place to test the LBCC and SERNEC Symbiota Portals which have ML and NLP incorporated in their workflows.





OCR fragments – insights and use

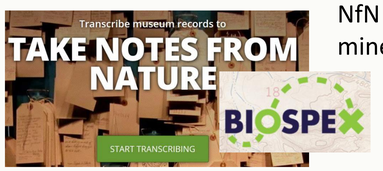
Searching OCR text to empower transcription and transcriptionists and scale-up digitization



Symbiota ID	Catalog Number	Family	Scientific name
1106109	SRP-L-0002722	Parmeliaceae	*Bryoria lanestris*
1125136	SRP-L-0003378	Verrucariaceae	*Catapyrenium cinereum*
1125366	SRP-L-0003685	Collemataceae	*Collema polycarpon*

NEW WORK *in progress* at SYMBIOTA

A batch NLP process tool allowing a collection manager to **batch parse stored OCR blocks for 100s of records at a time.** Depending on how well OCR parsing works for a given collection, processors will have to option to parse only selected targeted fields (e.g. collector, number, date). An option will be available to augment parsed data with content harvested from duplicate records already processed within other institutions.



NEW WORK *in progress* at NfN

NfN is collaborating with **Biospex** (an iDigBio project), to mine OCR output for descriptive metadata about expedition datasets. FUN, faster, and motivating for users!

Is Digitization Using These Methods Quicker?

The Royal Botanic Garden Edinburgh (RBGE) used OCR output text to speed up transcribing over 100,000 specimen labels. Creating recordsets for digitization faceted by collector and country **averaged 20 minutes (8.9%) faster to digitize per batch of 50 records than the next most efficient method.** See: Drinkwater RE, Cubey RWN, Haston EM (2014) The use of Optical Character Recognition (OCR) in the digitisation of herbarium specimen labels. PhytoKeys 38: 15–30. doi: 10.3897/phytokeys.38.7168.

Insights shared from NYBG

- Volunteers at NYBG use the LBCC and TTD-TCN Symbiota Volunteer Portals
- Volunteers use OCR text for **copying and pasting long localities.**
- OCR fragments make it possible to **create suitable records sets designed to maximize transcription efficiency.**
- Volunteers **use the LBCC Parser** in the Bryophyte Crowdsourcing Portal all the time -- it is **nearly accurate every time.**
- For older and handwritten labels (CINC), transcribers will learn to search records by OCR fragment to create cogent record sets.
- …and yes, there are challenges: slow servers, the need for more parsers, …

What about handwriting ?

Ask us about …

- Transcriptorium and Transcribus
- Berlin Botanic Garden (BGBM)
- Leiden and Naturalis, et al

Got ideas for making digitization *faster? Let's talk.*

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