

Harnessing Digital Sources for Sinology Research

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Naïve diagram of humanities research

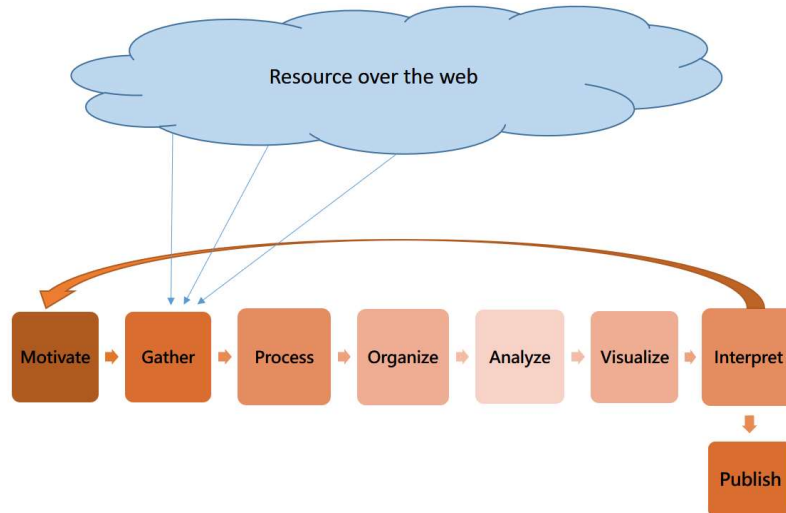


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What has changed in the digital world?



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How do most humanities scholars cope with the change?

- Draw research material from the Web (through search and retrieve)
- Then work on them pretty much the conventional way



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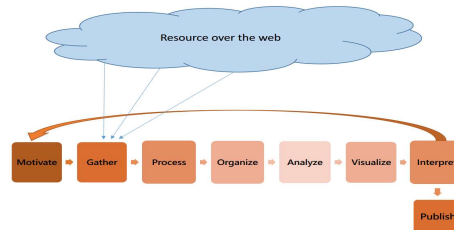
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- But we are using tools already...

What is missing with using the tools?



- There should be **tools for every step** of the research process (except interpretation, which is inherently a human effort) in an integrated fashion
- Some tools are hard to learn (especially GIS tools)
- Tools for **analysis are underutilized**
- No tools to help with access once the materials are downloaded
- No fluid **interaction** between content and tools
- No effective method to **connect** humanities scholars and tool developers

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Digital resources = digital contents + digital tools

Two main subjects in this talk

- Connecting digital contents and digital tools
- Connecting humanities scholars and IT researchers

Assumptions

- Contents are already in digital form
 - Going from analog to digital is important, but that's a different issue
- Work mainly with Chinese texts, not images
 - The principle is the same, but tools are different

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The digital library approach to develop scholarly content

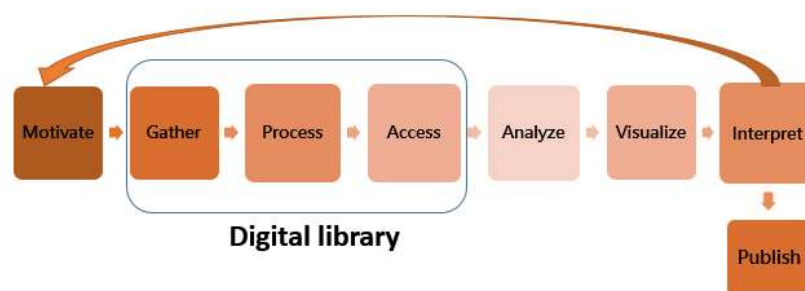
- Bypass individual research problem/motivation
- Data Collection
 - Comprehensively and systematically collect material of a specific domain (usually with institutional support)
- Data Processing
 - Organize and digitize material according to an SOP
- Data Access
 - Build a large scale digital library system
 - Access through browse and keyword search

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The digital library framework



- Focus on context collection, process, and access
- Instead of simple organization, build a database to access digitized material!

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Example: CBETA

- Full-text system of Buddhist canons built at Chinese Buddhist Electronic Text Association



- Example shows dates of books in which keyword appears
- All canons must have the era when it was translated

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Ex: THDL (Taiwan History Digital Library)

- Built by Research Center for Digital Humanities of NTU
- (Tagged) full-text of primary historical material of Taiwan, focusing on Qing dynasty
- Emphasize context discovery and analysis
- In addition to full-text search, provide *explainable textual contexts* (relations among documents) of a search result set
- RCDH has built over 30 large scale context-discovery systems on different historical materials and Chinese classics
 - Accessed by more than 25,000,000 sessions. Cited in >1,000 papers

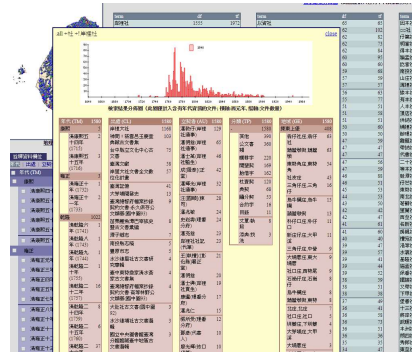
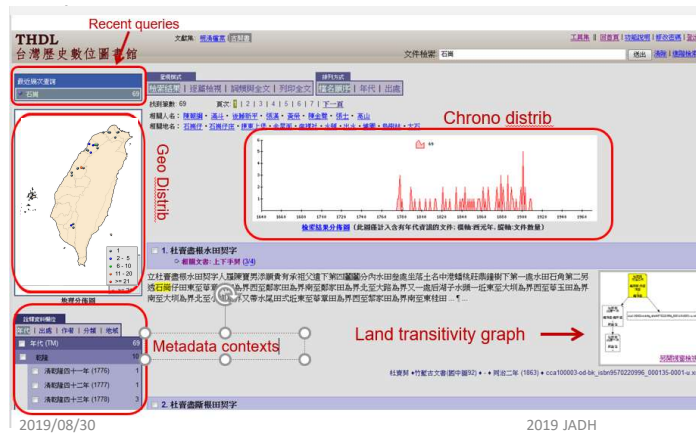
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Metadata contexts

- Contexts implicit in the metadata
- Chronological distribution, geographic distribution, authors, sources,



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Statistical contexts

- Contexts from statistical analysis of texts
- Co-occurrence of terms, term1 vs term 2, prefix/suffix analysis, etc



人名		Term t	df	t→q	回報
朱一貴	生平	245	1.000		
林爽文	生平	88	0.058		
常青	生平	53	0.038		
藍廷珍	生平	52	0.338		
滿保	生平	44	0.141		
施世驤	生平	39	0.639		
福康安	生平	36	0.023		
黃仕簡	生平	35	0.040		
任承恩	生平	30	0.076		
莊大田	生平	30	0.058		

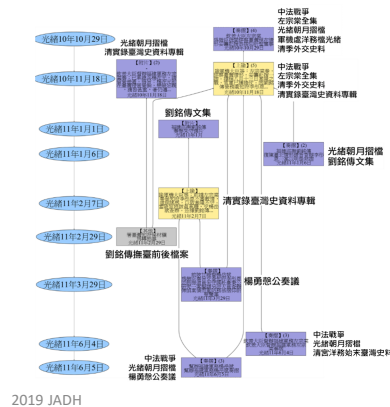
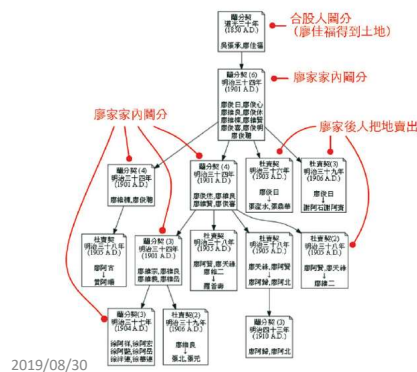
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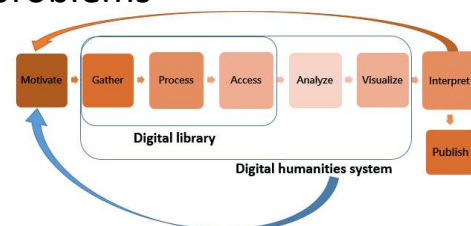
Semantic contexts

- Contexts that are domain-specific, usually require pre-computation
- Land transitivity graph (for land deeds), IE/M (imperial edicts/memorials) diagram



Context-discovery systems – pros

- Through extensively collecting of material on a specific domain, allow scholars to have systematic access of related research material
- Through context analysis, provide a bird-eye's view of a document set and basic contexts among documents
- Give a user an effective way to utilize retrieved documents
- Often lead to new discoveries of problems



Context-discover systems - shortcomings

- Contents and tools of a large DH system are tightly coupled
 - The database is read-only (can't easily add new material)
 - New functions can only be added by experts (mainly the designer of the system)
- But scholars usually have their own research focus and personal collection of related material
- Personal material cannot be incorporated into an existing context-discovery system nor can utilize the tools in the system
- In general, the personal need of the research cycle cannot be satisfied by using a static context-discovery system

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How to incorporate a user's own material into a large DH system?

Scholar's own land
deeds



THDL



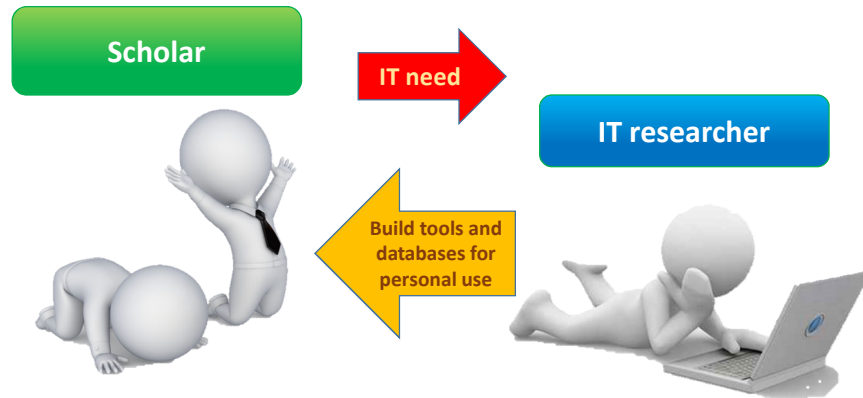
- You can't

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How to satisfy a humanities scholar's individual IT need?



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A DH platform for individual scholars to work in the digital environment

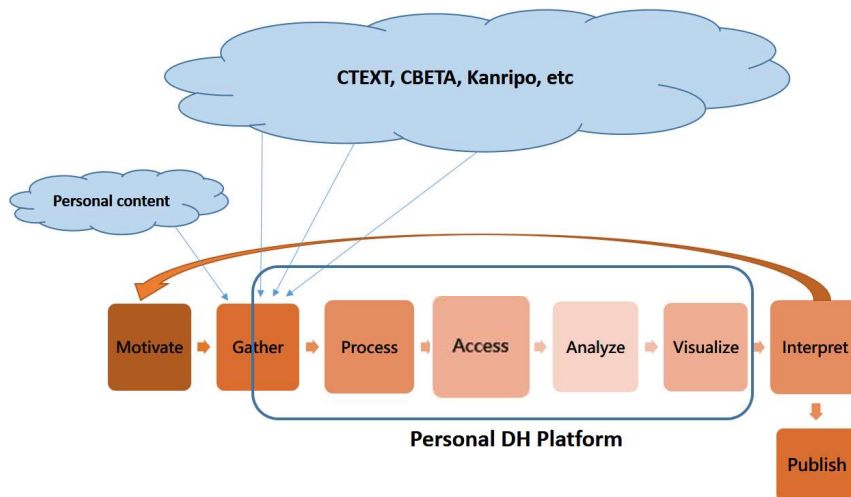
- Data collection
 - Tools to access/download relevant research material available on the Web
- Data processing
 - Tools to process (own and downloaded) material into proper form
- Data access
 - Simple way to build a personal DL to provide easy search and access of personal material
- Data analysis
 - Tools to analyze material and to find textual context
- Data visualization
 - Tools to provide visual presentations of analytic results

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DH platform for individual scholars



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System versus Platform

- | | |
|---|--|
| <ul style="list-style-type: none"> • Contents are fixed. Can't add personal content • Contents and tools are tightly coupled • Contents and tools can only be added by the administrator | <ul style="list-style-type: none"> • Contents can be added/removed/modified, accessed, used • Tools can be added independently • Contents and tools can interact freely • All users can add own content or tools and make them available to others |
|---|--|

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DocuSky: A personal DH platform



- Developed at RCDH, NTU
- Chief architect: Dr. Hsieh-Chang Tu
- Project manager: Dr. I-Mei Hung, Dr. Chijui Hu (co-MP)
- An attempt to realize the scenario given above
- Connecting (personal and Web) contents and tools
- Connecting scholars and IT developers

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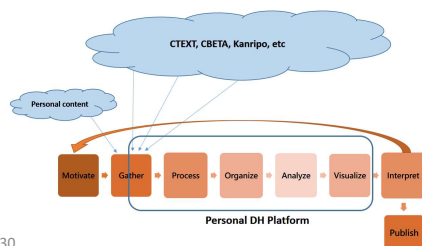
Division of work

Scholar

- Initiate research problem
- Gather related material
- Interpret results

DocuSky

- Obtain additional material over the Web
- Tools for processing material
- Create a searchable database of processed content
- Tools for analysis
- Tools for visualization



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The design principle of DocuSky

- DocuXML: a standard to connect contents and tools
- One-click personal database
 - With just one click, turn any document set in DocuXML format into a full-text searchable database with metadata context post-classification
- Utilize open access content
 - We don't create own content, unless necessary
- Utilize open access tools
 - We don't create own tools, unless necessary

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How to connect external tools?

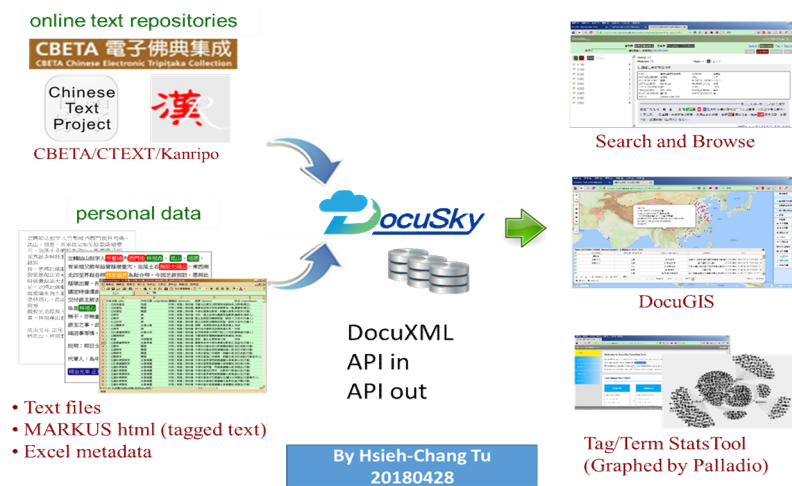
- To ensure the compatibility between existing tool's own format and DocuXML, sometimes need to write a converter if the tool uses a different format
- So far support csv, .xlsx (MS Excel), .txt, .html (Markus format), DocuXML

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An overall picture

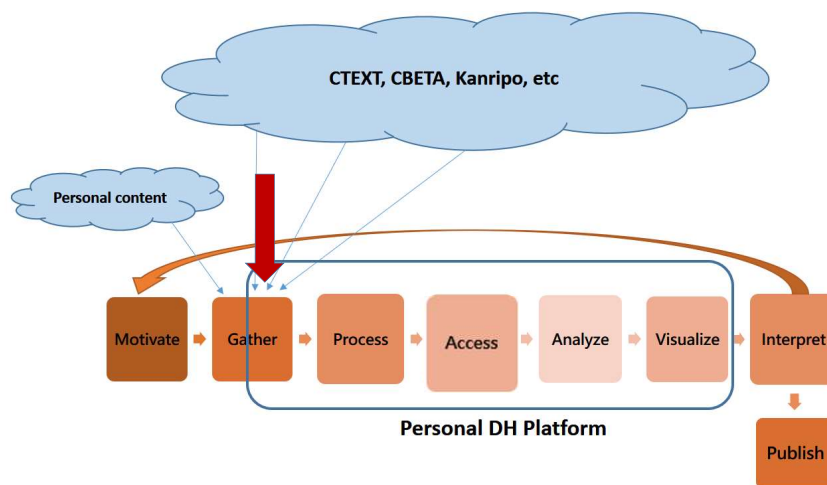


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How to access external content



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How to connect open access content?

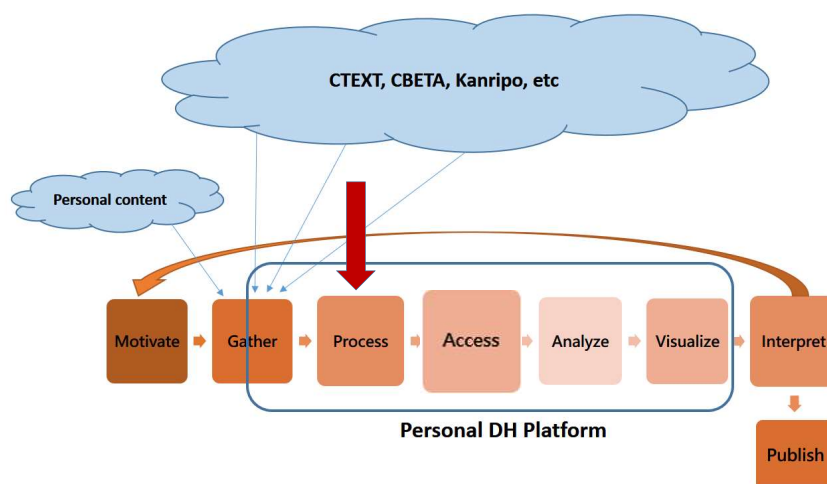
- Each open repository needs to be accessed separately, mainly through API
- Ctext.org
 - Obtain plain text through API
- Kanripo
 - Obtain plain text with simple metadata through API
- CBETA
 - Obtain files already in DocuXML form through API (thanks to Cbeta team)
- THDL
 - THDL sends files to DocuSky in DocuXML format
- Wikisource
 - Coming soon...

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Tools for processing/annotating content



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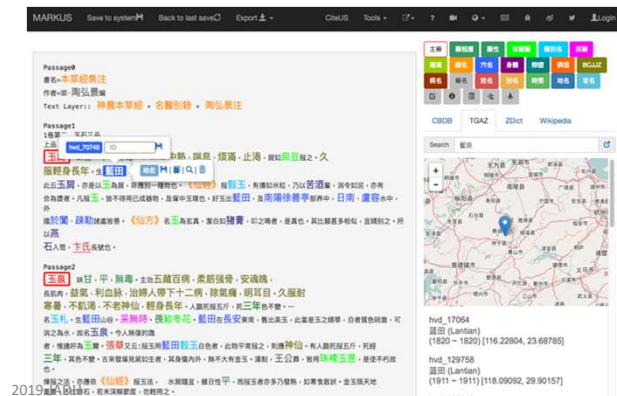
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Annotating tool(s): MARKUS

- Markus, developed at Leiden by Hilde De Weerd and Brent Ho
- Automatic markup of person names (using CBDB and others), place names (using CHGIS and TWGIS), temporal references (Dila)
- Keyword markup
 - User needs to create metadata attribute and list of terms
- Manual markup
- Comparativus
 - Comparing two texts
 - (Recently added feature)

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The importance of tagging

- Chinese lacks delimiter (such as space) to naturally separate words
- Tagging not only identifies meaningful words, but also enriches the usefulness of the text
- By using authority files such as CBDB, Markus enables the potential of linking texts to other tools (such as GIS) and semantic queries

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As a remark, when digitizing, we should...

- Build metadata
- Produce full-text when possible
- Include image when possible
- When possible, tag person/place names, normalize dates, tag objects, identify geographic coordinates

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An example of Bencaojin.jizhu (本草經集注)

- Obtain full-text of BCJ.JZ from Kanripo
- Use Markus to tag person name (with CBDB) and place names with coordinates (with TGAZ)
- Design additional tags such as #DrugName, #DrugProperty, #DiseaseName, #Harvesting, which with a list to tag by Markus automatically

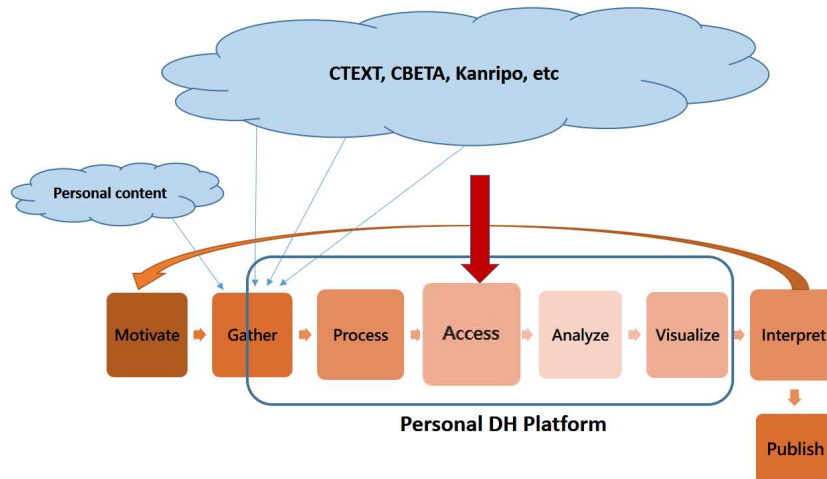
The screenshot displays the Markus application interface. The main window shows the text of 'Bencaojin.jizhu' with various tags applied. The tags include person names (e.g., #Hvd, #Lanlan), place names (e.g., #TGAZ), and other metadata. A sidebar on the right shows a map and a list of tagged items with their coordinates.

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For accessing the prepared content: build a searchable database with one-click



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Building a searchable database of DCJ.JZ

- Convert Markus result (.html) to DocuXML (a couple of clicks)
- One click to build database

```

        type="contentTagging"/>
        <tag name="Udel_BodyPart" default_sub_category="" default_category="Udel_BodyPart"
        type="contentTagging"/>
        <tag name="Udel_RecipeName" default_sub_category="" default_category="Udel_RecipeName"
        type="contentTagging"/>
        <tag name="Udel_MainGroupName" default_sub_category="" default_category="Udel_MainGroupName"
        type="contentTagging"/>
        <tag name="Udel_Acquaint" default_sub_category="" default_category="Udel_Acquaint"
        type="contentTagging"/>
    </feature_analysis>
</corpus>
<documents>
    <document filename="M0012abc.002_Bencaojing.jizhu_SNBC.MYBLTZ.txt_markus (2)_p0001">
        <doc_content>
            <Paragraph RefId="passage0">
                諸君
                <Udel_Textile>本草經疏</Udel_Textile>
                作爲
                <PersonName RefId="A0045313" Term="A0045313">陶弘景</PersonName>
                曰 Text Layer:
                <Udel_Textile>神農本草經</Udel_Textile>
                +
                <Udel_Textile>名醫別錄</Udel_Textile>
                +
                <Udel_Textile>陶弘景</Udel_Textile>
            </Paragraph>
        </doc_content>
        <filename="M0012abc.002_Bencaojing.jizhu_SNBC.MYBLTZ.txt_markus (2)_p0001">
            <Udel_Textile>M0012abc.002_Bencaojing.jizhu_SNBC.MYBLTZ.txt_markus (2)</doc_source>
            <corpus>本草經疏法</corpus>
        </document>
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```

[illegible]

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The BCJ.JZ DH (context-discovery) system

- <http://docusky.org.tw/DocuSky/webApi/webpage-open-3in1.php?db=%E6%9C%AC%E8%8D%89%E7%B6%93%E9%9B%86%E6%B3%A8&corpus=%E6%9C%AC%E8%8D%89%E7%B6%93%E9%9B%86%E6%B3%A8&queryBase=.all&spType=tagAnalysis&snippets=null>

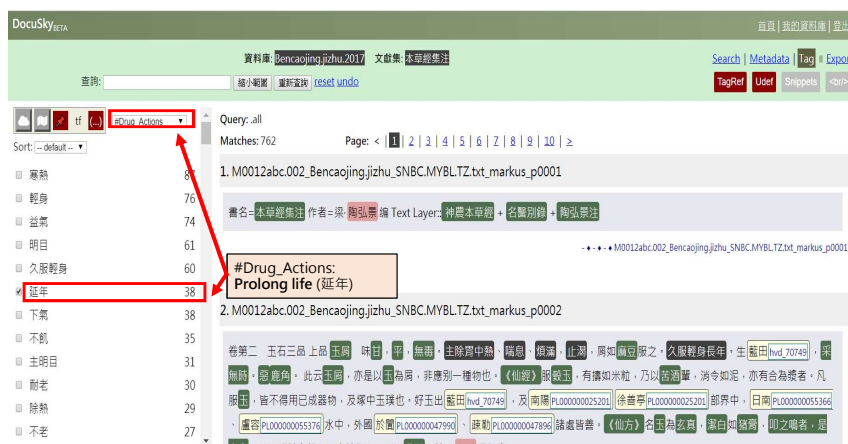


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BCJ.JZ system post-classification using #Drug_Actions



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What drugs prolong life (#MainDrugName)?

DocuSky_{BETA}

資料庫: Bencaojing.jizhu.2017 文獻集: 本草綱目

查詢: 檢小範圍 重新查詢 reset undo

Search Metadata Tag Export TagRef Udel Snippets

Query: 徐長卿.all

Matches: 7

Sort: Freq DESC

1. M0012abc.002_Bencaojing.jizhu_SNBC.MYBLT

#MainDrugName: Drugs with prolonging life effect

雲母 雲母，平，無毒，主治 身皮死肌，中風寒熱，如在車船上，除邪氣，安五藏，益子精，明目，下氣，堅肌，續絕，補中，療五勞七傷，虛損少氣，止痛，久服輕身，延年，悅澤不老，耐寒暑，治高神仙，一名雲珠，色多赤，一名雲華，五色具，一名靈英，色多青，一名靈液，色多白，一名靈砂，色青黃，一名靈石，色正白，生 太山 [PL000000021580] 山谷 青，[靈山 PL000000018775]，及 琅邪 [hvd_115519] 北定山石間，二月採，澤瀉 有之使，得 雞甲，反流水，煎 徐長卿，藥《仙經》雲母乃有八種：向日視之，色青白多黑者名雲母，色黃白多青者名靈英，色青黃多赤者名靈珠，如 冰 露 半 黃 半 白 名 靈 砂，黃白晶晶名靈液，皎然純白明澈名靈石，此六種并好服，而各有時月；其難難純黑，有文斑斑如蠟者，名靈脂，色雜黑而強肥者名靈，此二種並不可服，鍊之有法，惟宜精細；不斷，入腹大害人，今處方家九取用之，并只講節，殊為未允。琅邪 [hvd_115519] 在 彭城 [hvd_115667] 東北，青州 [hvd_112972] 亦有，今 江東 [PL000000000197] 惟有 靈山 [hvd_95162] 者為獨，以沙上養之，歲月生長，今鍊之用 靈石 則柔廣，亦便是相 關 之 功。百草上露，乃諸果流水，亦用 五月 茅屋漏水。

2. M0012abc.003_Bencaojing.jizhu_SNBC.MYBLT.T7.txt.markus.p0008

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Tagging cloud of drugs that prolong life



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Connecting CBDB and DocuGIS



What books were used in bcj.jz?
Using suf-pref query: “< xxxxxxxxxxxx >”

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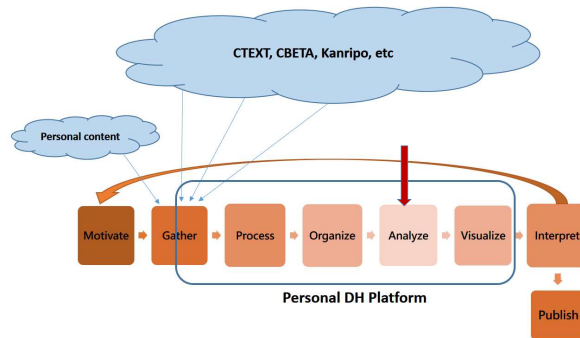
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Sampling of tools (term-stat and DocuGIS)

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Analytic tools in DocuSky

- Discovery tools
 - Word-clipping
 - Document recommendation
 - Text comparison (forthcoming)
- Statistical tools
 - Word frequency
 - Tag/term stats tool: comparing word occurrences among documents



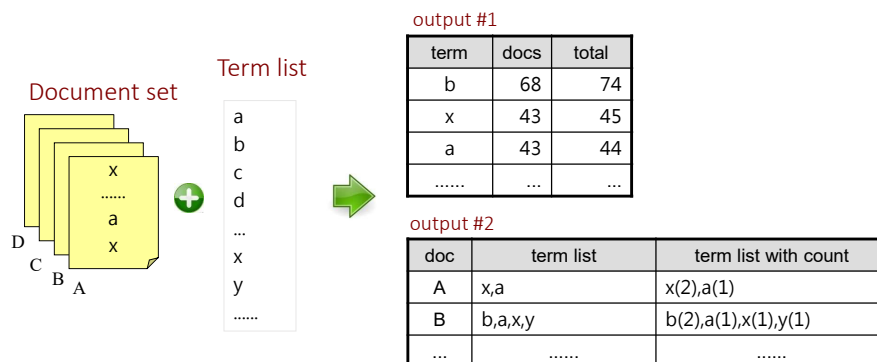
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Tag/Term Stats Tool (Bo-yu Hsieh)

- Purpose: word frequencies in documents
- Given texts and a list of terms, generate frequencies in several formats to be used by other tools



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Simple example of Term StatsTool

- Texts: Taiwanese news (9,497 reports)
- Terms: common idioms (5,152 idioms)

1. 挖東牆補西牆 美國縮小減赤 -- XaoHeNews_01551

今年10月 美國 聯邦政府開閉的審議，讓自動減赤 (sequester) 機制的衝擊益發受到重視。民主黨與共和黨 會議員於10日完成協商，同意將國防以及教育、交通及國家公園等內政相關的財政預算，排除在自動減赤的範圍內，總金額達650億美元 (約新台幣2兆元)。根據兩黨協商內容，這筆650億美元的預算雖免受刪減，但聯邦政府必須在10年內，想辦法持續提出開源方案，並增加其他預算項目的節流幅度，補回850億美元以充盈國庫、打消國債。猶悉協商成果出爐，美國總統歐巴馬立即發表聲明，表示兩黨協商「走出漂亮的第一步」。根據兩黨協商討論框架，美國此一預算年度將有1兆美元可資運用。參眾兩院將於近日表決此修正案。2011年美國國會通過《預算控制法》(BudgetControlAct)，其中包含自動減赤機制。根據法案，2013年美國聯邦政府必須刪減850億美元，並於10年內累積刪減1兆2億美元。刪減的預算項目無所不包，從國防、健保、教育、公共福利、科學研究等項目盡皆在內，對於美國的影響不可謂不大。今年美國政府的財政缺口至9月30日為止，已經縮小37.5%，較2009年減少一半，加上今年個人所得稅增加，減赤目標接近達陣。美國財政部長隆伍 (Jacob Lew) 指出，這個數據可望讓國會對於自動減赤的執行網開一面。美聯社指出，此次兩黨預算協商的金額，對於美國高達17兆美元的國債並無實質影響，只是稍微舒緩未來2年兩黨的預算之戰的激烈程度。根據協商內容，這筆650億美元中的450億將會於當前財政年度消耗完畢，剩下的200億美元則會由參眾兩院逐年撥款使用，避免聯邦政府開關危機再現。保守派人士則是對協商內容大加抨擊，表示參與協商的國會議員合謀背棄2011年的《預算控制法案》，視當年茶黨及共和黨國會議員的努力為無物。保守派組織「黨禁美國」(AFP) 發表聲明，要求眾院的共和黨議員堅守立場，擱下此一修正案。聲明中指出：「某些共和黨國會議員與民主黨成了『丘之貉』，一再打破諾言，不願把守政府無度浪費的行為，並留下17兆的債務給後代。」



idioms	#news	times
不可思議	68	74
流離失所	43	45
層出不窮	43	44
史無前例	40	44
雪上加霜	38	40
捲土重來	37	40
當務之急	37	39
軒然大波	37	37
手無寸鐵	33	35
岌岌可危	33	33
責無旁貸	31	32
一意孤行	26	28

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Frequencies of words in corpuses

- Corpuses: Quantangshi (全唐詩), Quansongci (全宋詞)
- Lists of terms: Beasts and Birds from Taipinyulan (太平御覽)

全唐詩	47957則	全宋詞	18932則	全唐詩	47957則	全宋詞	18932則
馬	4396	馬	1226	鳥	3365	燕	1804
猿	1234	虎	271	鶴	2176	鳳	1099
虎	931	牛	246	鳳	1951	雁	1010
牛	710	貂	197	雁	1868	鶴	827
鹿	540	兔	171	燕	1404	鸞	798
犬	405	猿	160	雞	984	鴻	696
羊	400	犀	156	鴻	935	鷗	535
兔	332	羊	123	烏	736	鳥	458
狼	230	鹿	76	鸞	728	烏	428

- Importance of Apes (猿) dropped significantly (from 2.57% to 0.85%)
- Importance of Swallow (燕) increased significantly (from 2.93% to 9.53%)

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Visualization of co-occurrence of terms in corpora (Hsieh-Chang Tu)

- Given several document sets (corpora), and a list of terms
 - Question: what are the common terms among two or more corpora?
 - What terms only appear in one corpus?

Steps

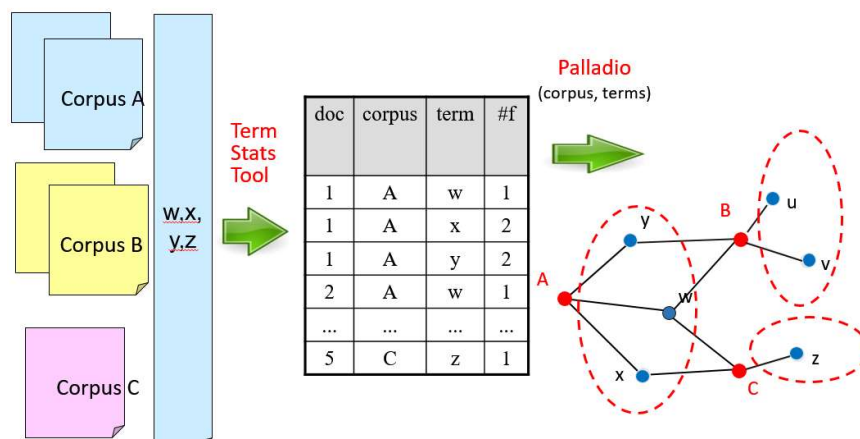
- Prepare corpora/term list
- Feed them to term stats tool
- Export the output in csv to Palladio (Stanford)

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Term co-occurrence graph (TCG)



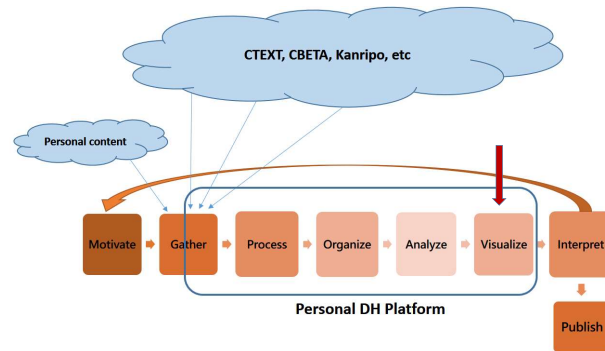
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Visualization tools in DocuSky

- Geographic tools
 - Geoport
 - DocuGIS
- Social network tools
 - Developed at Stanford
- Temporal tools
 - DocuTime (forthcoming)
- Comparative reading of several texts



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Why DocuGIS?

- I have a text and I want to know the locations of the places mentioned, but GIS can only be done by experts, right?
- Even if I can plot the points, can I interact with it?
- Can I see the locations in its original historical setting?

DocuGIS (Dr. Nung-yao Lin)

- Easy to learn. Everyone can do it
- Provide interaction through full-text search

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Travel route of Xuanzang according to *Pilgrimage to the West during Tang Dynasty* (大唐西域記)

- Full-text of PtWdTD
 - Download from ctext using DocuSky API
 - (PtWdTD describes the same travel as the fiction *The Journal to the West* 西遊記, but was written by the monk Xuanzang himself)
- Geographic locations
 - Dharma Drum location authority (<http://authority.dila.edu.tw/place/>)
- Build Excel file of names and locations of places and the full-text
- Obtain csv from the Excel file
- Upload to DocuGIS and done!

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Making the Excel of PtWdTD

One click to turn Excel into csv

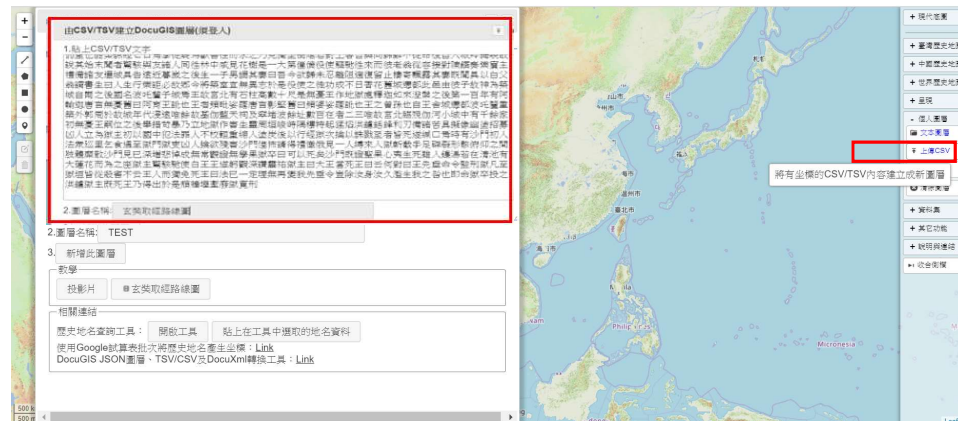
	A	B	C	D	E	F	G
	id	corpus	compilation_name	PlaceName	x	y	text
1	1	大唐西域記	序	長安	34.2662	108.9532	
2	2	大唐西域記	序	秦州	34.9478	105.5689	
3	3	大唐西域記	序	蘭州	36.0471	103.8561	
4	4	大唐西域記	序	涼州	37.9272	102.4838	
5	5	大唐西域記	序	張掖	38.9336	100.459	
6	6	大唐西域記	序	玉門關	40.8309	96.3526	
7	7	大唐西域記	序	伊吾	42.8203	93.5278	
8	8	大唐西域記	序	高昌	42.7987	89.5878	
9	9	大唐西域記	阿耨尼國	阿耨尼國	41.9821	86.5054	阿耨尼國東西六百餘里南北四百餘里國大都城周六七里四面障山道險易守泉流交帶引水為田
10	10	大唐西域記	屈支	屈支	41.7175	82.9727	屈支國東西千餘里南北六百餘里國大都城周十七八里宜藥麥有梗稻出蒲葡萄石棗多梨桃杏上
11	11	大唐西域記	跋祿迦國	跋祿迦國	41.169	80.2682	跋祿迦國東西六百餘里南北三百餘里國大都城周五六里土宜氣序人性風俗文字法則同屈支國
12	12	大唐西域記	凌山	凌山	41.342183	78.469621	此則葱嶺北原水多東流矣山谷積雪春夏合凍雖時清泮尋復結冰終歲險阻寒風慘烈多暴龍險峻
13	13	大唐西域記	大滑池	大滑池	42.4	77.4	大滑池或名熱海又謂鹹海周千餘里東西長南北狹四面負山衆流交澆色帶青黑味鹹鹹苦洪濤浩
14	14	大唐西域記	素葉水城	素葉水城	42.9365	75.128	素葉水城城周六七里諸國商人雜居也土宜藥麥蒲葡萄林樹稀疎氣序風寒人衣氍毹素葉已西數十孤
15	15	大唐西域記	千泉	千泉	42.675	73.4752	千泉者地方二百餘里南面雪山三垂平陸水土沃壤林樹扶疎暮春之月雜花若綺泉池千所故以名
16	16	大唐西域記	呾摩私城	呾摩私城	43.3506	70.1006	呾摩私城城周六九里諸國商人雜居也土宜氣序大同素葉南行十餘里有小孤城三百餘戶本中國
17	17	大唐西域記	白水城	白水城	42.3208	69.7386	白水城城周六七里土地所產風氣所宜逾勝呾摩私西南行二百餘里至恭師城城
18	18	大唐西域記	呾摩私城	呾摩私城	41.436317	69.546663	呾摩私城城周六九里諸國商人雜居也土宜氣序大同素葉南行十餘里有小孤城三百餘戶本中國

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Paste csv to DocuSky, then choose upload

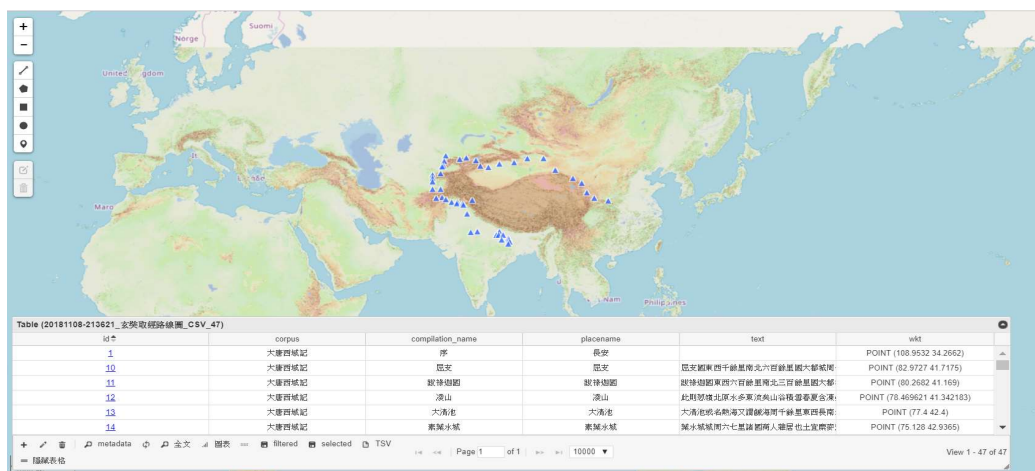


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Searchable GIS system of PtWdTD completed!



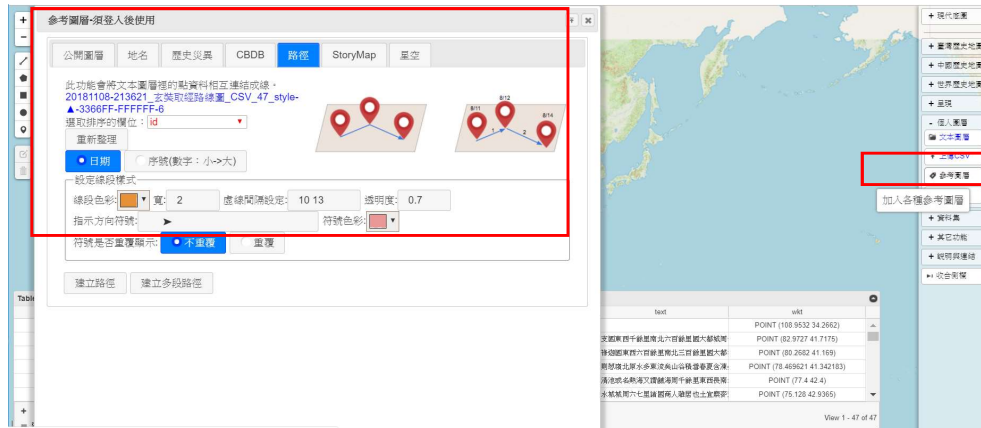
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How to plot the route?

- Use Index as order, and choose "route" in the reference map option

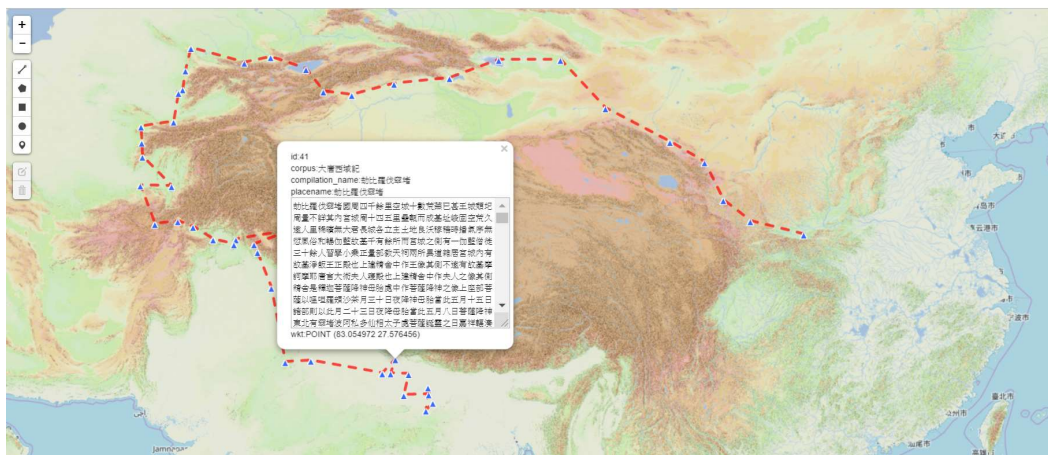


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One click and the route is complete



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Interaction with user: query with Brahman (婆羅門)

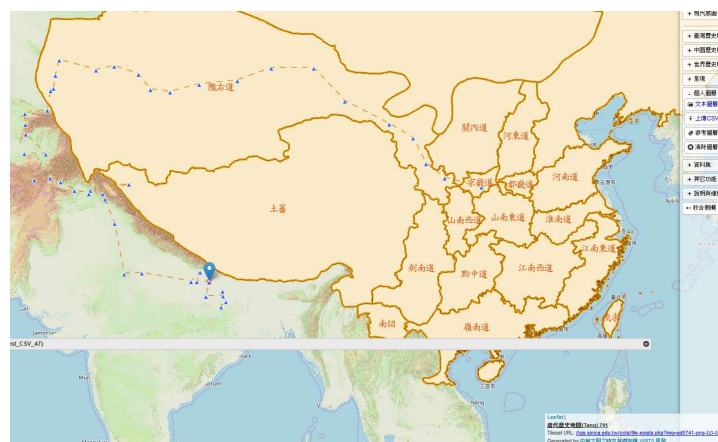


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Replacing the map by a Tang map (map courtesy of Academia Sinica)



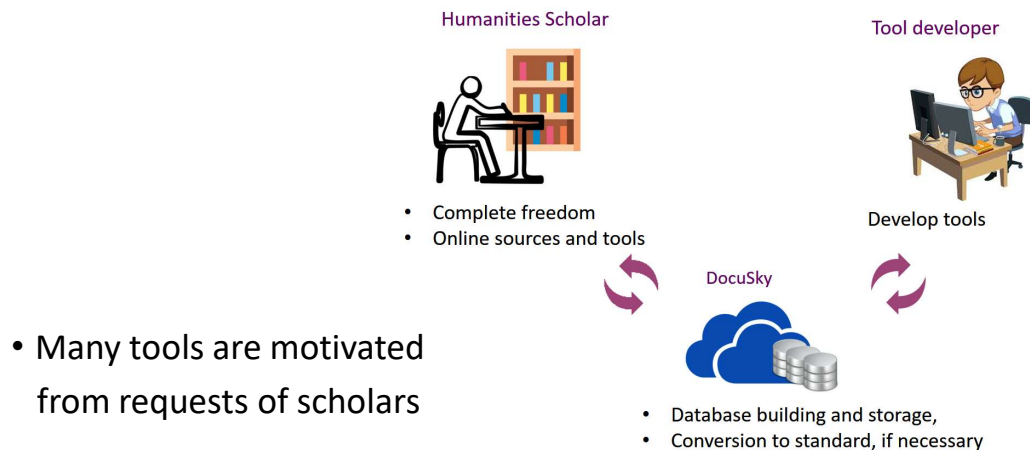
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Connecting scholars and tool developers

- Through DocuXML and other common formats such as csv



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Who built DocuSky?

Built by full-time staff

- The platform architecture
- DB-builder
- DocuXML standard
- DocuWidgets
- Term-stat tools
- Some converters

Built by students and external

- Most converters
- Dialogue annotator
- Batch tagging tool
- Metadata attachment tool
- DocuGIS (and other GIS tools)
- DocuTime lite
- CompareReader
- Markus (*Leiden*)
- APIs (Cbeta API done by *DILA*)
- Palladio (*Stanford*)

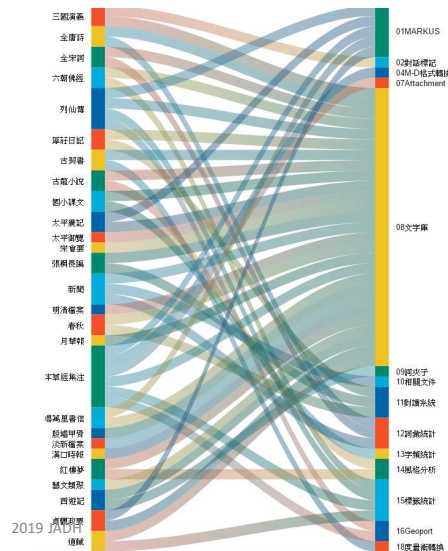
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The DocuSky experiment so far

- Over a thousand registered users
- Corpora used by scholars range from Ying Oracles to elementary textbooks, at least 100 cases
- Over 15 workshops/tutorials targeting conducted at China, Singapore, U.S. and Taiwan

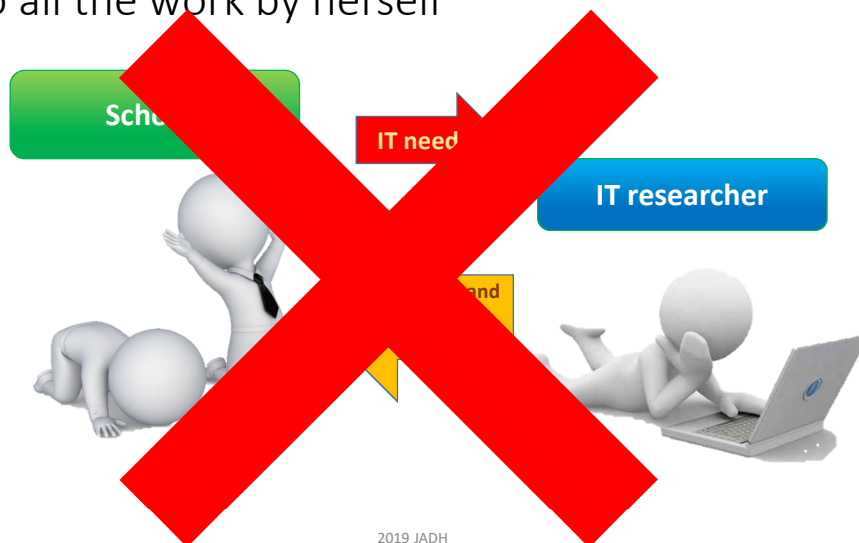


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DocuSky: a digital platform on which a scholar can do all the work by herself



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Concluding remarks

- We advocate the division of work between a scholar and digital tools, and that effective utilization of tools is the only way to harness the complexity raised by digital contents
- To do so we propose a new concept of platform with which new contents and new tools can be incorporated easily
- DocuSky aims at becoming such a platform where a scholar can work with digital contents and tools without losing independence
- DocuXML provides a way for tools and contents (and their developers) to participate and interact
- A lot more need to be done...

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Thank you
<http://docusky.org.tw>
<http://www.digital.ntu.edu.tw>

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