

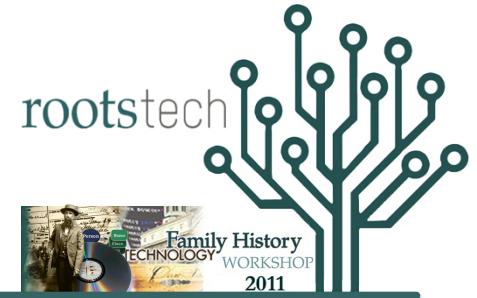


Family History Technology:

Where have we **Been?**
BEEN ...

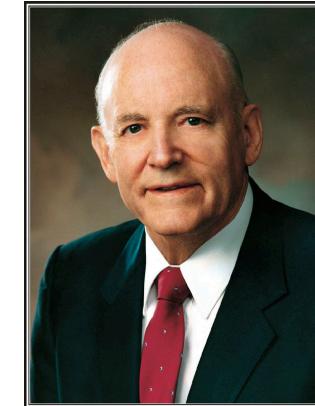
... and where are we **GOING?**

William Barrett
Department of Computer Science
Brigham Young University



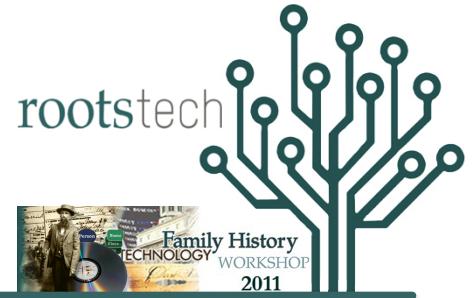
Family History Technology

“The Lord has guided the development of information technology and accelerated its role in work for the dead, and will continue to do so. However, we stand only on the threshold of what we can do with these tools. I feel that our most enthusiastic projections can capture only a tiny glimpse of how these tools can help us - and of the eternal consequences of these efforts.”



-President Howard W. Hunter, 100th anniversary of the Genealogical Society of Utah

Technology Milestones in Family History



1927 1938 1963 1969 '70 '84 '90 '93 '99 '01 '05 '11

Past Century

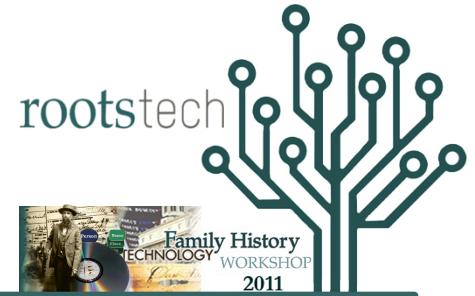
Technology Milestones in Family History



Family History

TIB	microfilm	Granite Vault	IGI	PAF	Family Search						
1927	1938	1963	1969	'70	'84	'90	'93	'99	'01	'05	'11
					Gedcom		Temple				
					GIANT		Ready				
					(Genealogical Indexing And Name Tabulation)		AI/ Research				
					Fuzzy Matching, search with name variants, locality		Guidance				
								familysearch.org			
									Social		
									Genealogical	Networks/ websites	Collaboration
									share/edit		

Technology Milestones in Family History



Family History

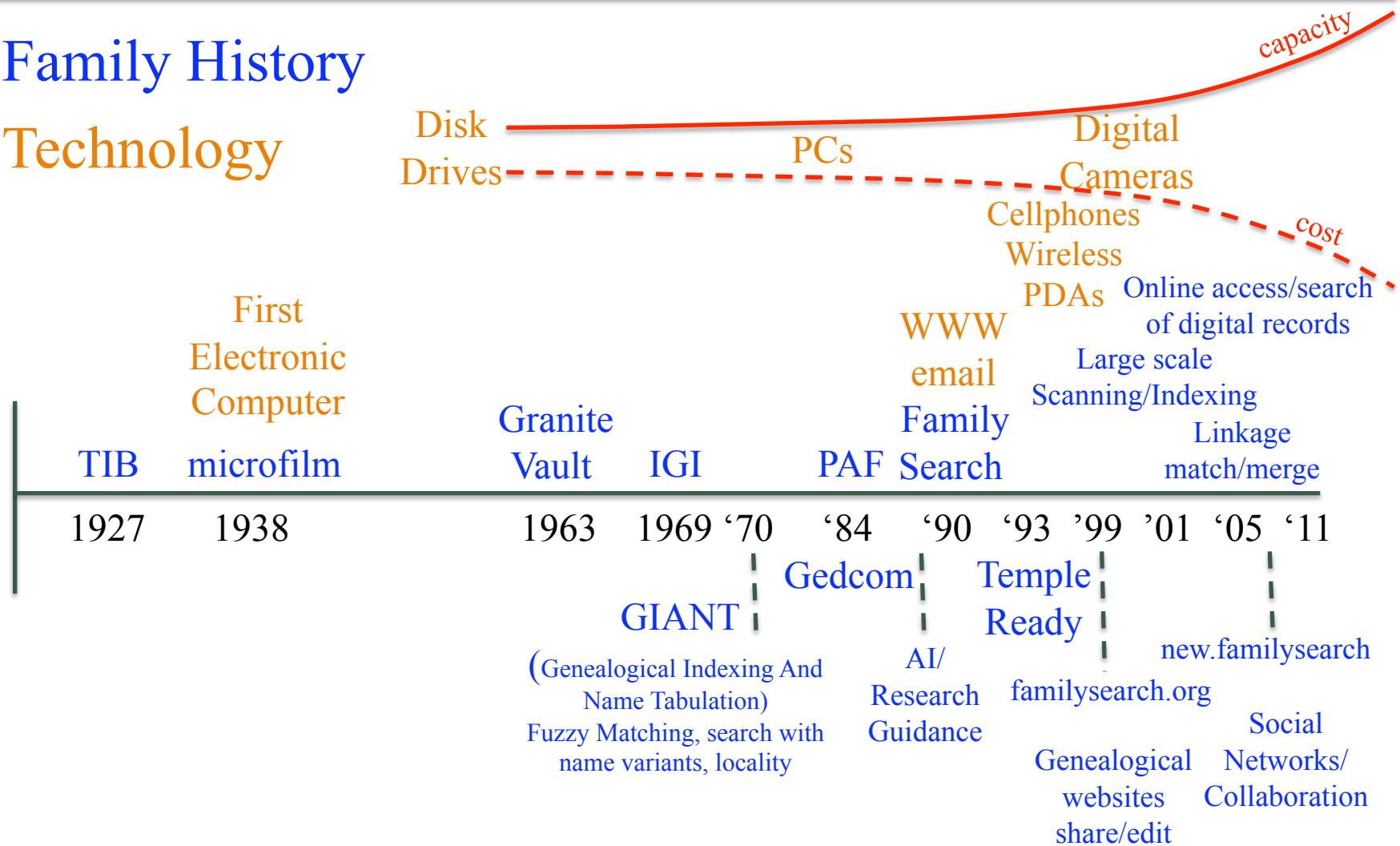
Technology

	Disk Drives		PCs	Digital Cameras	
TIB	First Electronic Computer	Disk Drives	PCs	Digital Cameras	
1927	microfilm	Granite Vault	WWW	Cellphones	
1938		IGI	email	Wireless	
		PAF	Family Search	PDAs	Online access/search of digital records
		'84		Large scale Scanning/Indexing	
		'90		Linkage match/merge	
		'93			
		'99			
		'01			
		'05			
		'11			
			Gedcom	Temple Ready	
			GIANT		
			(Genealogical Indexing And Name Tabulation)		
			Fuzzy Matching, search with name variants, locality		
			AI/ Research Guidance		
				new.familysearch	
				familysearch.org	
				Social	
				Genealogical Networks/ websites	
				Collaboration	
				share/edit	

Technology Milestones in Family History



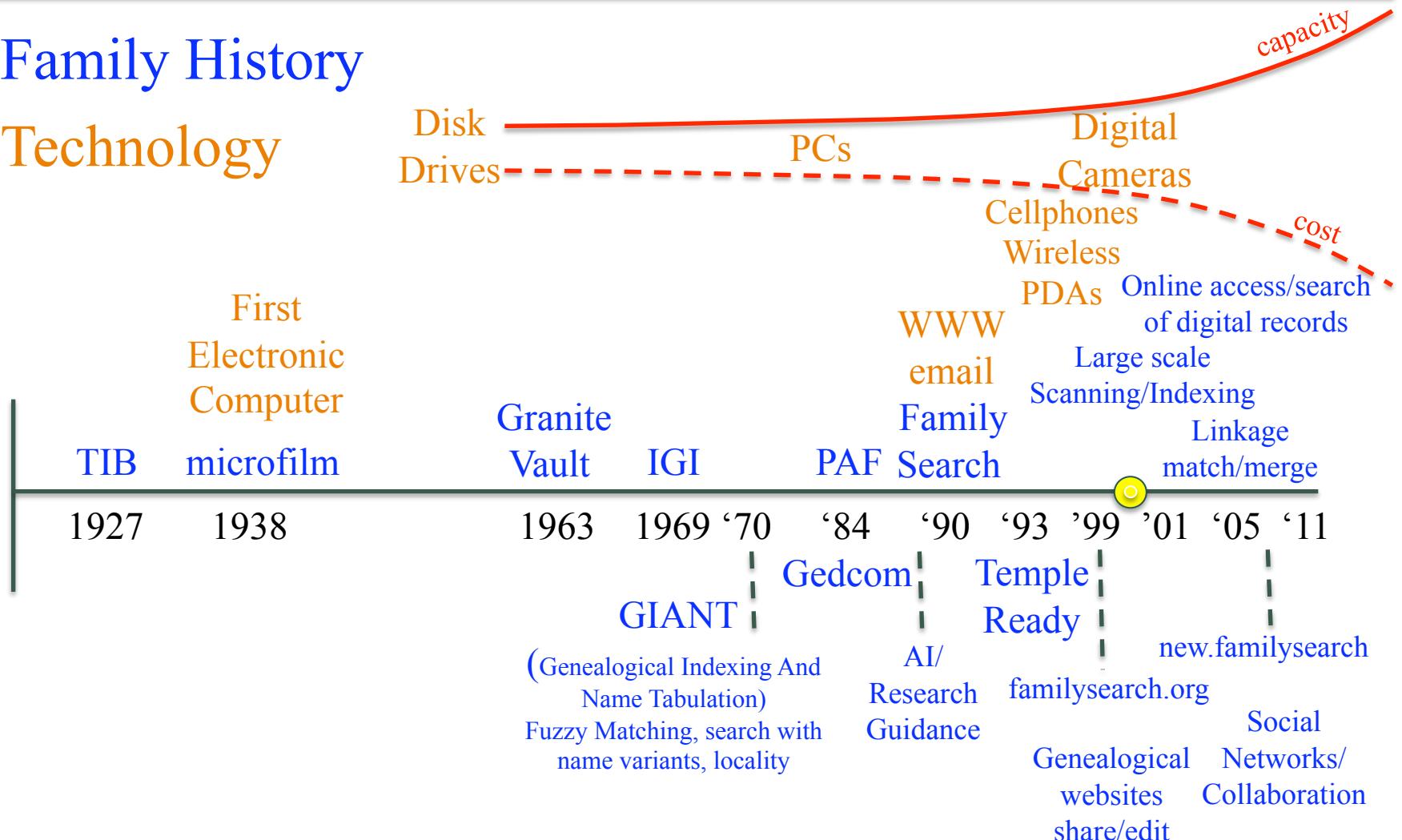
Family History Technology



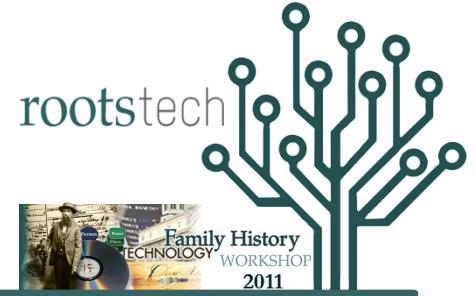
Technology Milestones in Family History



Family History Technology



Family History Technology Workshop (fht.byu.edu)



BYU | BRIGHAM YOUNG UNIVERSITY

Search BYU



Family History Technology Workshop

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- [Local Arrangements](#)
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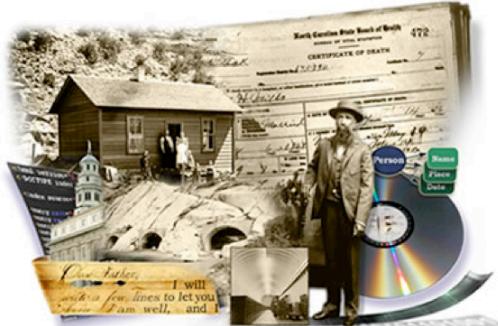
Related Conferences & Workshops

- [Computerized Genealogy Conference](#)
- [Annual BYU Genealogy & Family History Conference](#)

**Click here for information on the
2011 Conference**

10th Annual Workshop on Technology for
Family History and Genealogical Research

April 28, 2010
Salt Lake Convention Center



Current Technology Innovation in the CS Department

- [Digital Roots](#)
- [OnePage Genealogy](#)
- [Relationship Finder](#)

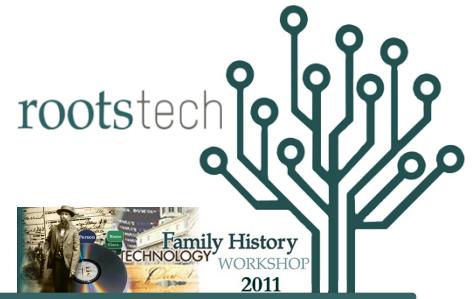
Important Dates

January 21, 2011
Papers Due
February 11, 2011
Day of Conference

Previous Workshops

- [2010](#)
- [2009](#)
- [2008](#)
- [2007](#)
- [2006](#)
- [2005](#)
- [2004](#)
- [2003](#)
- [2002](#)
- [2001](#)

Creators + Users



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FAMILYSEARCH. WHERE GENERATIONS MEET

CONFERENCE ON COMPUTERIZED
FamilyHistory
& GENEALOGY

2010 LOCATION CHANGE
SALT PALACE, SALT LAKE CITY
With the National Genealogical Society Conference

Conference on Computerized Family History and Genealogy Other Family History Programs BYU Conferences and Workshops

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Credit Requirements
Call for Papers
2010 Flier
2010 Site
2009 Flier
2009 Site

Related Items
Family History Technology Workshop
FamilySearch Developers Conference
Genealogy & Family History Conference

Tools
Tell a Friend
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Announcement
Brigham Young University is pleased to participate with FamilySearch in redesigning three former conferences, the Conference on Computerized Family History, the Technology Workshop and the FamilySearch Developers Conference, all together and offering even more to those interested in the important work of family history.
More info about RootsTech...

The new conference will be called RootsTech and will be held **February 10-12, 2011** at the Salt Palace in Salt Lake City.

Join the Mailing List to stay informed about BYU Genealogy Conferences.
You can also view the previous 2010 Conference on Computerized Family History and Genealogy site

DCE Web Team | Brigham Young University, Provo, UT 84602 – 801-422-4636 – Copyright © 2010, All Rights Reserved

UNIVERSITY Search BYU

Family History Technology Workshop

Click here for information on the 2011 Conference

10th Annual Workshop on Technology for Family History and Genealogical Research
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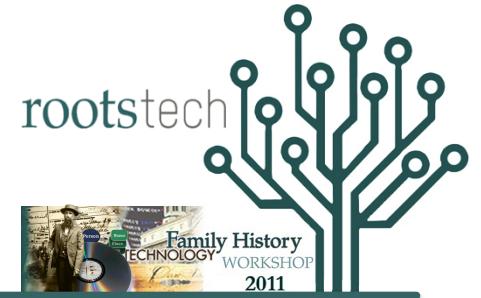
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Previous Workshops
• 2010
• 2009
• 2008
• 2007
• 2006
• 2005
• 2004
• 2003
• 2002
• 2001

Current Technology Innovation in the CS Department
• Digital Roots
• OnePage Genealogy
• Relationship Finder

Sponsored by: BYU Computer Science • CS Alumni Association • BYU
© 2011 BYU Computer Science Department

Users + Implementers + Creators
= Rootstech





Advances (FHTW today)

- Record Match – Patrick Schone
Evaluation/merge – precision/recall - useable
- Historical Social Networks – Doug Kennard
History by association (Ancestral Pioneer Past – 1997)
- Record Linkage – Randy Wilson
Machine Learning Algorithms
– improves with data, large training sets, features
- Folk Date Pattern – Justin Selliger – user-friendly date range input
- Deep Zoom (Pivot) – Engh, Gehring
Intuitive, interactive, visually explore, browse, cull large data corpus, including photos
- Preserving, promoting perpetuating innovation, solutions, challenges:
“Competition” – Luke Hutchison



Advances (Beau Sharbrough)

- availability of records
- innovative linking of records

2 trees link to same vital record

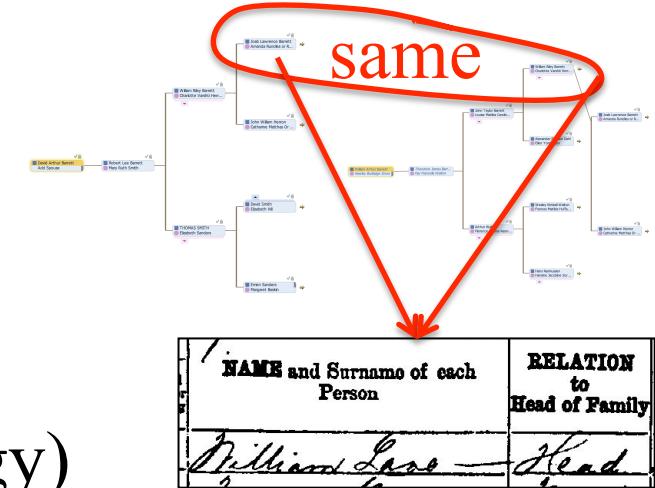
⇒ same person

(Ancestry's “shaky leaf” technology)

- Family History site-building technologies (TNG)
- Knowledge Base of Records

+

Individual Tree Information



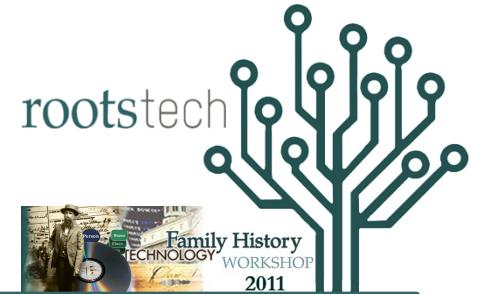
Research Task List

(GenSmarts)



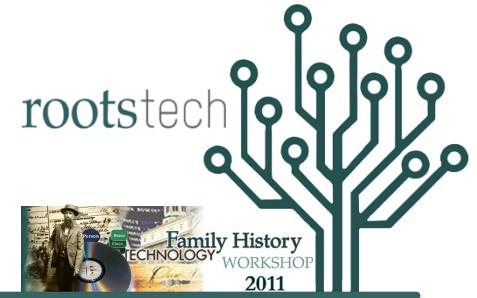
Advances (Dallan Quass)

- Matching people in family trees with records
- Large-scale, accessible infrastructure for collaboration and social networking
 - Facebook, Twitter, Google Wave
- Increased access to genealogical information
 - Billions of searchable records (Ancestry, FamilySearch)
 - Increase in number of microfilms indexed (“ ”)
- Genealogy Wiki's for sharing of information:
 - Wiki.familysearch.org, WeRelate



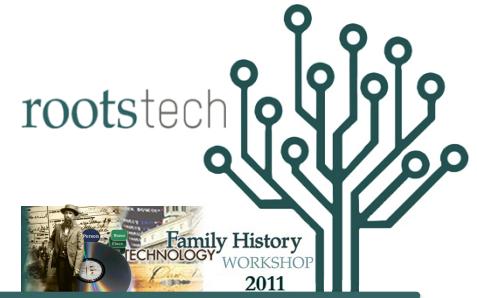
Advances (Heath Nielson)

- Interactive Genealogical Websites where content can be changed, added to and shared)
- Increased access to source records
- Increased storage capacity and bandwidth enabling the scanning, storing and serving of records across the Internet



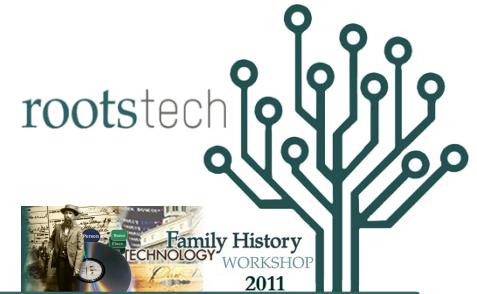
Advances (Kirk Duffin)

- Online searching and browsing through
 - Hierarchical digital image transmission
 - Automatic scanning and processing of microfilm
 - Associated storage technologies
- Progress in automatic matching / merging
- Human-assisted computing where full automation is not yet possible (e.g. handwriting, speech recognition)



Advances (Jack Reese)

- Scanning, storage, indexing and search technologies:
lowered cost, time => increased productivity, success
- Digital imaging (high-speed, high-res, low-cost replacing – film-based technologies)
- Bandwidth (high-speed, low-cost, last-mile to in-home delivery – replacing trips to archives, libraries, etc.)
- Search engines (aggregate and make searchable collections previously fragmented and distributed around the world)
- Hinting (finds and suggests likely matching records automatically showing connection to existing tree)
- Social networking (collaboration, quickly learn what has been done, less duplication and reinventing the wheel)



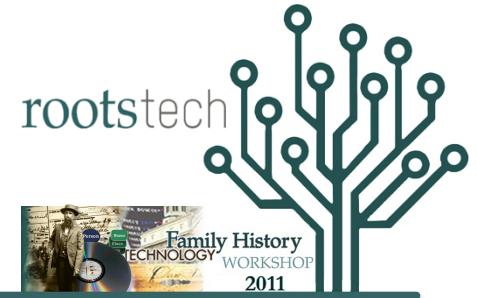
Advances (Alan Eaton)

- Single, unified, online family tree wherein everybody's view is sharable and preserved (OGF)
- Images tied to indexes
- Source standardization
- Mass digitization of records
- Indexing utilizing the masses
- Velocity of indexing
- Cloud computing concepts
(including GenealogyCloud.com)



Advances (Bill Harten)

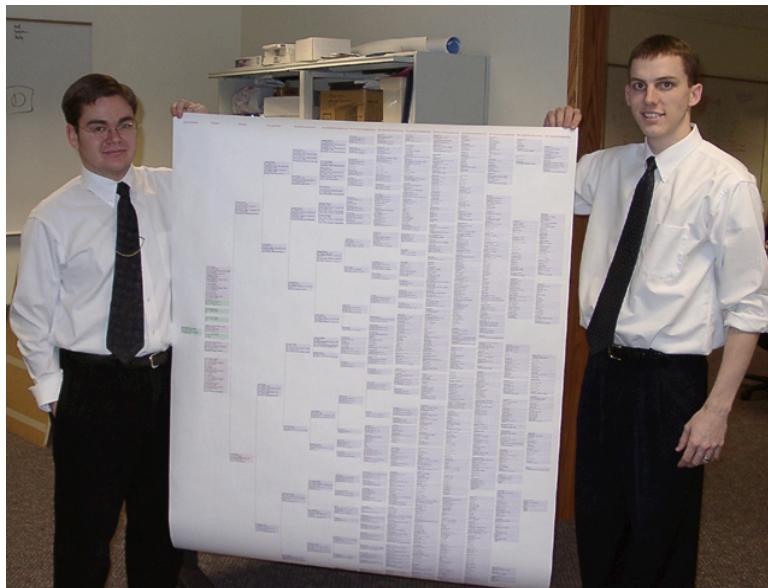
- Key Advances (That We Have Yet To Take Advantage Of)
- Affordable storage and delivery infrastructure for evidence images
- The union of LDS official ordinance records with extended linkage
- Research guidance tools to help researchers select the best source for their research objective



Advances (FHTW)

- Transliteration of non-roman text – Lonsdale
- Automating Exposure for Microfilm Scanning
 - Nielson, et al (Scanstone)
- Machine-learning, neural net: Record Linkage, matching
 - Giraud-Carrier, Pixton
- Social Networks for Family History – Giraud-Carrier
- Geo-Location Personal Names – Brown, Lonsdale
- WeRelate.org World's largest genealogical wiki – Quass

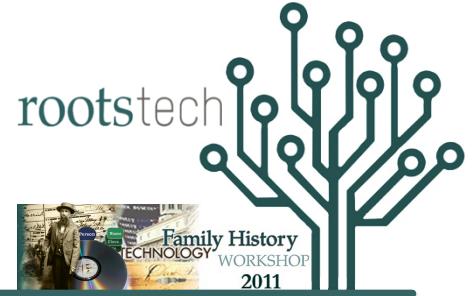
www.onepagegenealogy.com



14-generation pedigree
on 1 page

Relative Finder

(<http://roots.cs.byu.edu/digroots/>)



Welcome to Relative Finder(Beta)!

Relative Finder can tell you how you are related to prophets! **are undergoing some update**

Haven't used the site before? Click here to get started.

Relatives of William Barrett *****
Kimball: Becky's FFFFFFFFP = your MFFMFFFFP = R. KIMBALL(1595,England); U. SCOTT(15
Lund: Ryan's MMFFMFMMFMP = your MFFFMMMFMP = D. BAXTER(1626,Massachusetts); E. (16
Larsen: Alan's FFMFMFP = your MMFFP = C. JACOBSEN(1732,Denmark); K. JORGENS
...
***** Relatives Among the Prophets:
Smith: Joseph's FFFFMP = your MFMMMFMMFP = T. FRENCH(1608); M. SCUDAMORE(1612,Eng
Young: Brigham's MFMMMF = your MFFFMMFFF = F. PEABODY(1613,England)
...
Packer: Boyd's MMFFF = your MMMFMFF = A. ANDERSSON(1730,Sweden)
...
Kimball: Heber's FFFFFP = your MFFMFFFFP = R. KIMBALL(1595,England); U. SCOTT(15
...

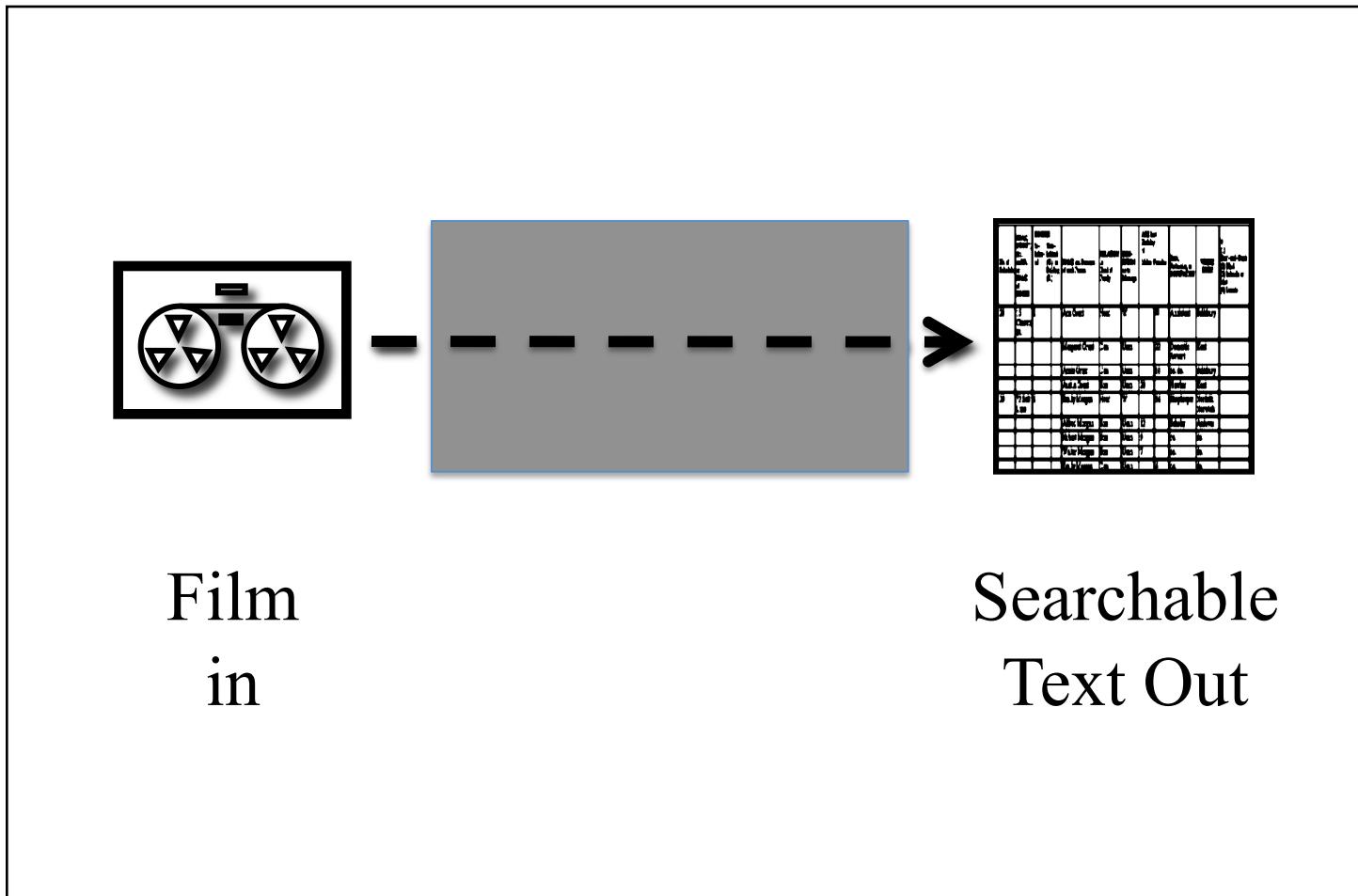
William Barrett, you are of royal lineage. Here are some of your royal ancestors.

Henry III (1206-1272) King Of ENGLAND is your 21st greatgrandfather.
Louis VIII "the Lion" (1187-1226) King Of FRANCE is your 22nd greatgrandfather.
Phillipp II (1176-1208) King Of GERMANY is your 23rd greatgrandfather.

You are participating in the beta test of Relative
click here to give us feedback.

Find out how you are related to your friends and many other famous people, leaders, kings, queens, etc.

The Digital Microfilm Pipeline*

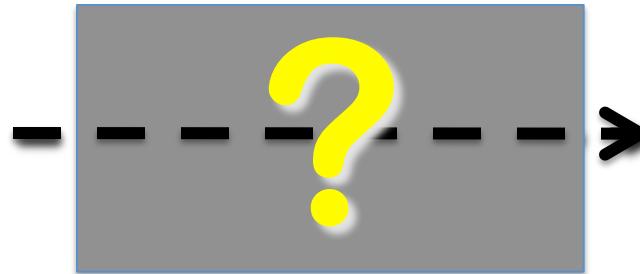
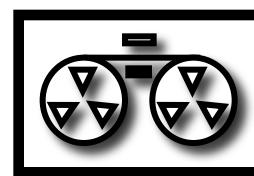


* Ty Davies, Jake Gehring

The Digital Microfilm Pipeline



What's inside the box?

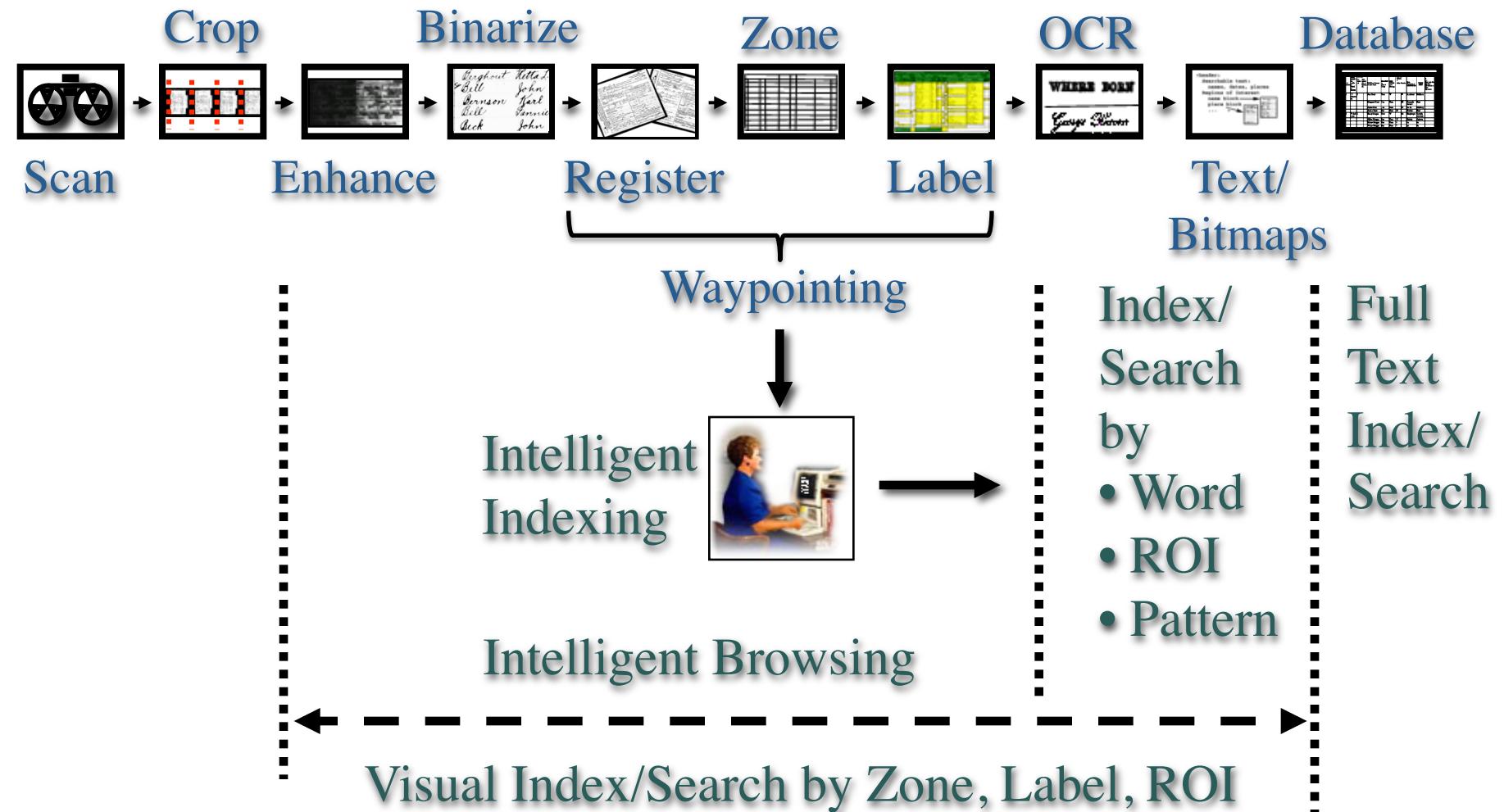


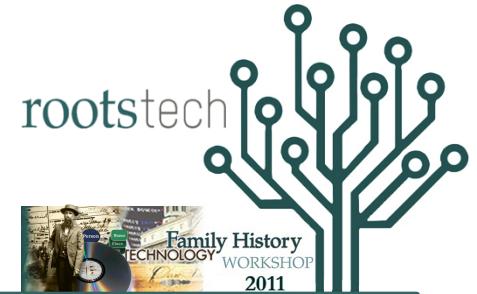
Name	Age	Gender	Race	Ethnicity	Physical		Cognitive		Social		Emotional	
					Height	Weight	IQ	Memory	Friendship	Family	Self-Esteem	Anxiety
John Doe	18	Male	Caucasian	American	5'10"	180 lbs	120	Good	High	Low	High	Medium
Jane Smith	22	Female	African American	American	5'5"	150 lbs	115	Medium	Medium	Medium	Medium	Medium
Mike Johnson	30	Male	Asian	Canadian	6'2"	200 lbs	130	Excellent	Medium	Medium	Medium	Medium
Sarah Williams	25	Female	Middle Eastern	Canadian	5'7"	160 lbs	118	Good	Medium	Medium	Medium	Medium
David Lee	28	Male	Hispanic	American	5'9"	175 lbs	122	Good	Medium	Medium	Medium	Medium
Emily Davis	21	Female	Caucasian	American	5'4"	145 lbs	112	Medium	Medium	Medium	Medium	Medium
Kevin Green	26	Male	Asian	Canadian	6'1"	210 lbs	132	Excellent	Medium	Medium	Medium	Medium
Laura Brown	24	Female	Middle Eastern	American	5'6"	155 lbs	116	Good	Medium	Medium	Medium	Medium
Chris White	29	Male	Hispanic	American	5'8"	165 lbs	124	Good	Medium	Medium	Medium	Medium
Olivia Black	23	Female	Caucasian	American	5'3"	140 lbs	114	Medium	Medium	Medium	Medium	Medium
William Grey	32	Male	Asian	Canadian	6'0"	205 lbs	131	Excellent	Medium	Medium	Medium	Medium
Alexandra Purple	27	Female	Middle Eastern	American	5'5"	152 lbs	117	Good	Medium	Medium	Medium	Medium
Bryce Orange	20	Male	Hispanic	American	5'7"	162 lbs	113	Medium	Medium	Medium	Medium	Medium
Claire Yellow	22	Female	Caucasian	American	5'4"	148 lbs	115	Good	Medium	Medium	Medium	Medium
Drew Green	28	Male	Asian	Canadian	6'2"	212 lbs	133	Excellent	Medium	Medium	Medium	Medium
Ella Blue	21	Female	Middle Eastern	American	5'6"	158 lbs	119	Good	Medium	Medium	Medium	Medium
Fiona Red	25	Female	Hispanic	American	5'3"	142 lbs	111	Medium	Medium	Medium	Medium	Medium
Gavin Purple	29	Male	Caucasian	American	5'8"	168 lbs	126	Good	Medium	Medium	Medium	Medium
Hannah Green	23	Female	Asian	Canadian	5'5"	154 lbs	118	Good	Medium	Medium	Medium	Medium
Ivan Blue	27	Male	Middle Eastern	American	5'7"	166 lbs	122	Good	Medium	Medium	Medium	Medium
Jasmine Red	20	Female	Hispanic	American	5'4"	146 lbs	116	Medium	Medium	Medium	Medium	Medium
Karen Purple	24	Female	Caucasian	American	5'6"	151 lbs	119	Good	Medium	Medium	Medium	Medium
Liam Green	28	Male	Asian	Canadian	6'1"	208 lbs	134	Excellent	Medium	Medium	Medium	Medium
Mia Blue	22	Female	Middle Eastern	American	5'3"	144 lbs	117	Good	Medium	Medium	Medium	Medium
Natalie Red	26	Female	Hispanic	American	5'5"	159 lbs	121	Good	Medium	Medium	Medium	Medium
Oscar Purple	29	Male	Caucasian	American	5'8"	172 lbs	128	Good	Medium	Medium	Medium	Medium
Parker Green	21	Male	Asian	Canadian	5'6"	157 lbs	120	Good	Medium	Medium	Medium	Medium
Quinn Blue	25	Female	Middle Eastern	American	5'4"	149 lbs	119	Good	Medium	Medium	Medium	Medium
Riley Red	23	Male	Hispanic	American	5'7"	164 lbs	123	Good	Medium	Medium	Medium	Medium
Sophia Purple	27	Female	Caucasian	American	5'5"	153 lbs	121	Good	Medium	Medium	Medium	Medium
Taylor Green	20	Male	Asian	Canadian	5'9"	202 lbs	135	Excellent	Medium	Medium	Medium	Medium
Ulysses Blue	24	Female	Middle Eastern	American	5'6"	156 lbs	122	Good	Medium	Medium	Medium	Medium
Vivian Red	28	Male	Hispanic	American	5'4"	148 lbs	115	Medium	Medium	Medium	Medium	Medium
Wesley Purple	22	Female	Caucasian	American	5'7"	150 lbs	118	Good	Medium	Medium	Medium	Medium
Xavier Green	26	Male	Asian	Canadian	6'0"	200 lbs	132	Excellent	Medium	Medium	Medium	Medium
Yara Blue	23	Female	Middle Eastern	American	5'5"	155 lbs	124	Good	Medium	Medium	Medium	Medium
Zoey Red	27	Male	Hispanic	American	5'3"	147 lbs	116	Medium	Medium	Medium	Medium	Medium

What processing steps have to happen in between?

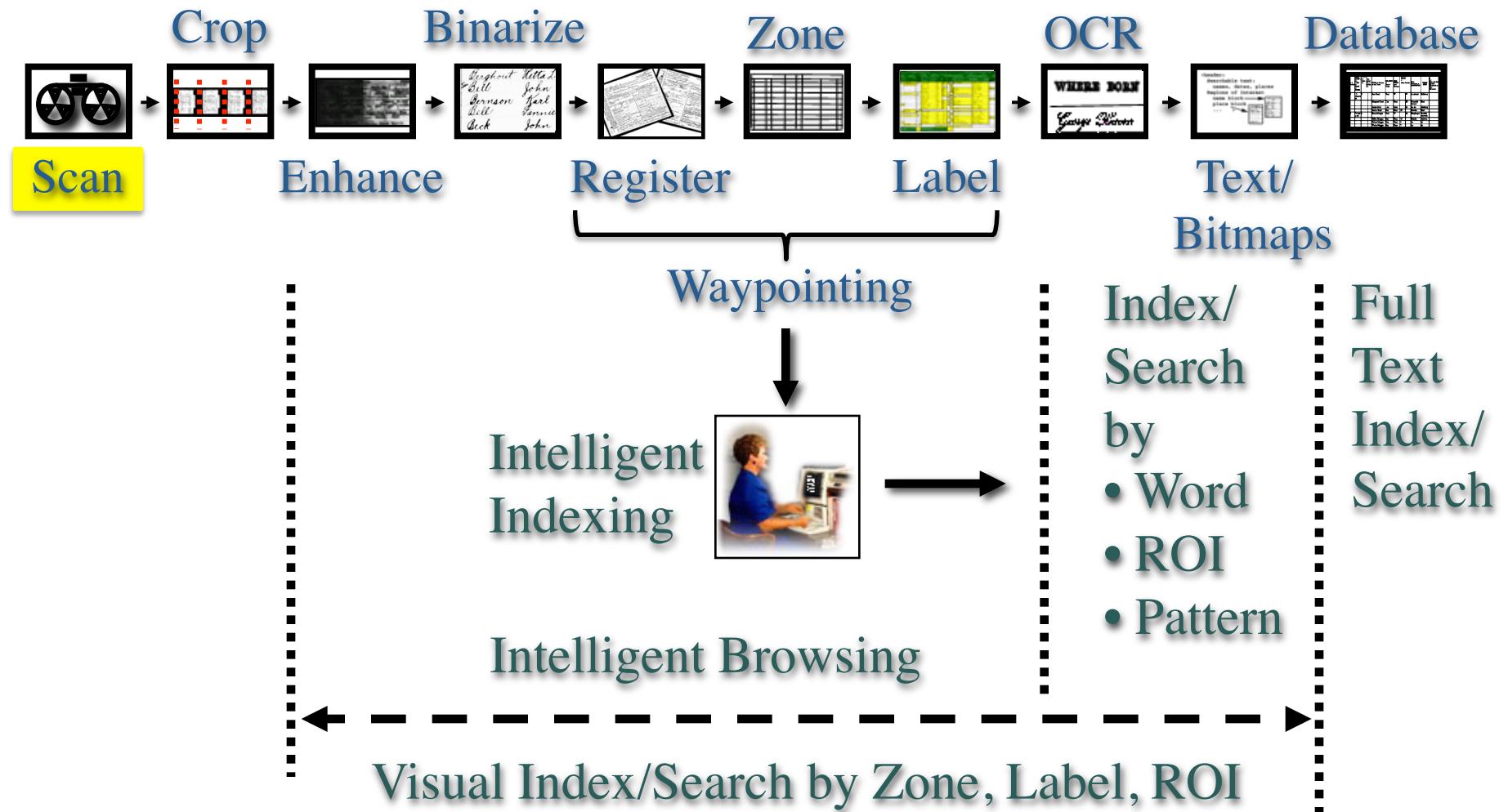


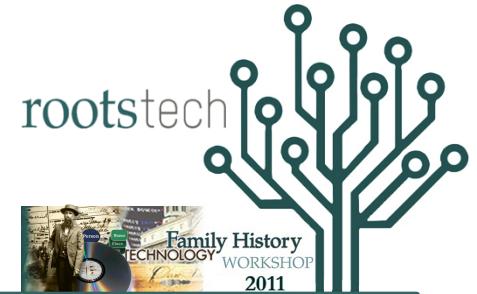
The Digital Microfilm Pipeline





The Digital Microfilm Pipeline





Scanning the Granite Vault

2.5 Million rolls of microfilm

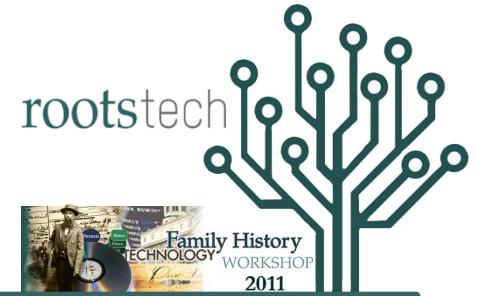
~ 1300 images per roll



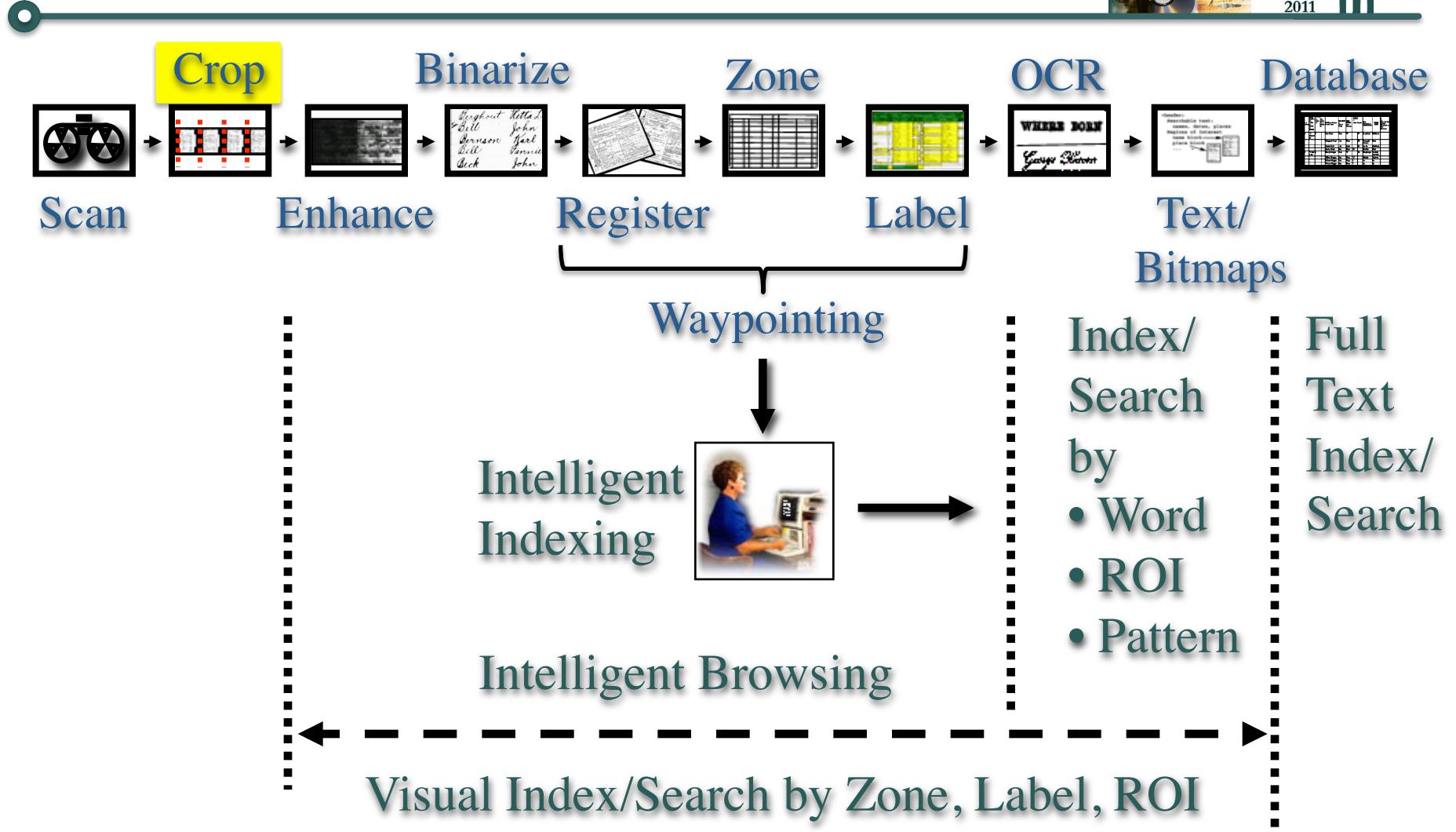
Up to 25 Megabytes per image

$1300 \times 25,000,000 \times 2,500,000$

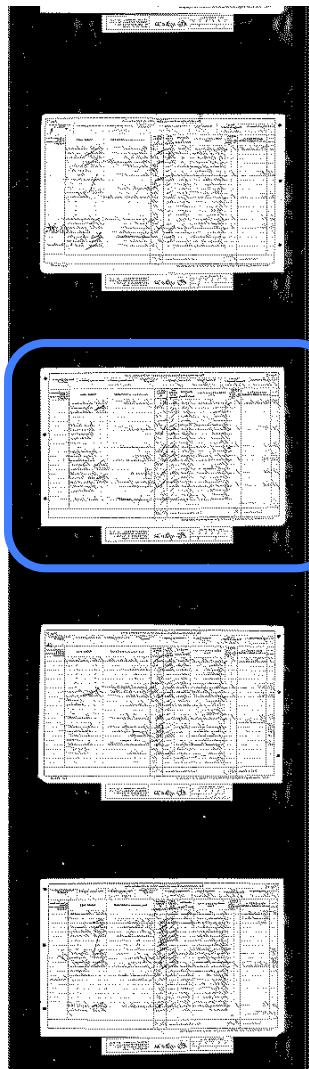
= 81.25 Petabytes



The Digital Microfilm Pipeline



Cropping



Example

The undermentioned Houses are situated within the Boundaries of the Civil Parish for Township of St. Mary, Municipal Borough of Shrewsbury, Municipal Ward of Welsh Shrewsbury, Parliamentary Borough of Shrewsbury, Town or Village or Hamlet of Shrewsbury, Urban Sanitary District of Shrewsbury, Rural Sanitary District of Shrewsbury, Ecclesiastical Parish or District of St. Michael.

18

No. of Schedules	ROAD, STREET, &c. and No. or NAME of HOUSE	HOUSES	NAME and Surname of each Person	RELATION to Head of Family	CON-DITION Marriage	AGE last Birthday Male/Female	Rank, Profession, or OCCUPATION	WHERE BORN	II Date of Birth (Exact Date or Estimate)
4	1, Charlotte St. ("Queen's Arms")	1	Michael Marion	Head	Mar.	37	Licensed Victualler	Midhurst; Tidington	
			Mary J. Do.	Wife	Mar.	29		Tidby; Cadeaux	
			Ellen Do.	Daus.		7		Tidby; Shrewsbury	
			Elizabeth Marion	Mother	W.	55	Annuitant	Tidby; Shrewsbury	Lunatic
			Ann Fox	Serv.	Unm.	28	General Serv.	Do.; Andover	
			John Fox	Serv.	Unm.	24	Reeman	Do.; Andover	
			Charles Doyle	Serv.	Unm.	21		Edland	
5	8, Charlotte St.	1	Lambert Penca	Head	Mar.	59	Grocer; (master, employing 2 men)	Cambridgeshire; Wigton	
			Emma Do.	Wife	Mar.	36		Do.; Longtown	
			William Do.	Son		12	Soldier	Tidby; Ludlow	
			Hannah Do.	Daus.		9	Do.	Do.; Do.	Dorset-Dorset
			George Blom	Apprentice	Unm.	19	George's Skipperman	Midhurst; Faversham	
			Jane Cook	Serv.	Unm.	22	General Serv.	Scotland	
			James P. Phillips	Head	Mar.	41	Baker's Chil	Yethelde; Leeds	
			Harriet Do.	Wife		39		Do.; Bradford	
			Sophia White	Serv.	Unm.	16	General Serv.	Tidby; Bridgwater	
6	Do.	10							
7	1, Bird Lane	1	William Farmer	Head	Mar.	72	Couch Turner	Staffordshire; Goldstone	
			Anne Do.	Wife	Mar.	69		Do.; Tonmouth	
			Henry Johnson	Head	Wid.	68	Retired Grocer	Do.; Weston	
			Emma Do.	Daus.		59	Coyenant	Tidby; Shrewsbury	Blind
			Jane Farmer	Apprentice	Unm.	41	Court Mabs	Midhurst; St. Pancras	
			Walter Campbell	Lodger	Unm.	18	Court Mabs (widow)	Tidby; Ludlow	
						23	Ship Carpenter (out of employ)	Durham; Sunderland	
	Total of Houses...	4	16						
		23							
	Total of Males and Females...		9						
			13						

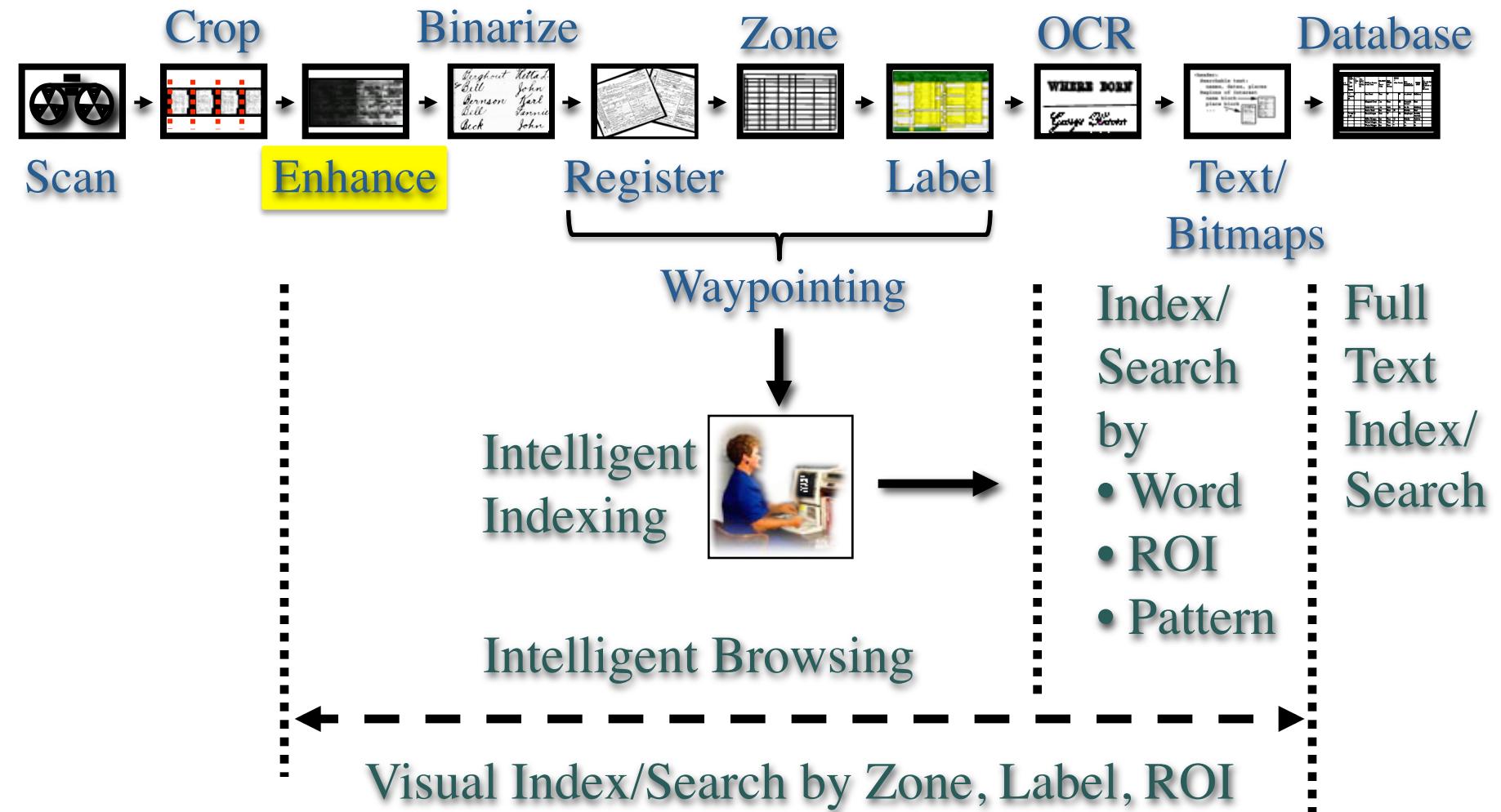
PUBLIC RECORD OFFICE	Reference-
1 2 3 4 5 6	RG 11/2072.
COPYRIGHT PHOTOGRAPH - NOT TO BE REPRODUCED PHOTOGRAPHICALLY OR IN ANY OTHER WAY WITHOUT PERMISSION OF THE PUBLIC RECORD OFFICE, LONDON	

- Scan continuously in Ribbons →
- Crop in batch, exploit consensus →

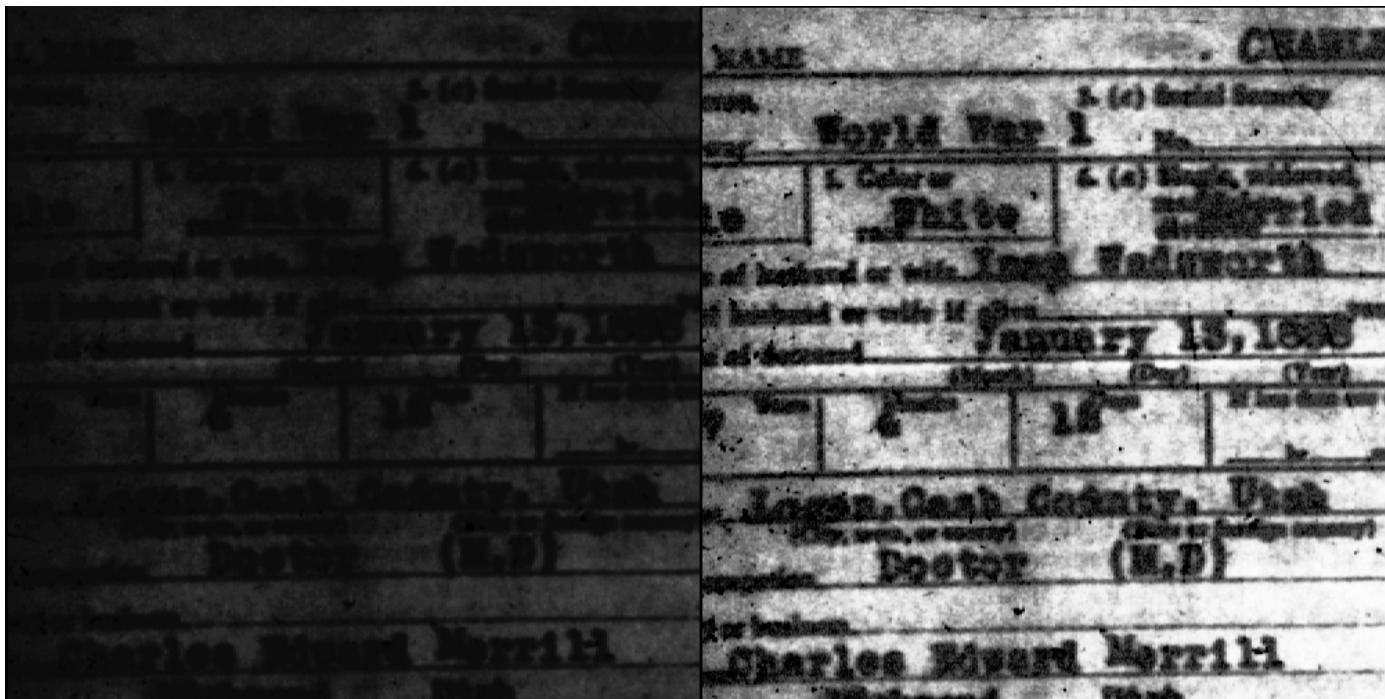




The Digital Microfilm Pipeline



Histogram Enhancement



(Left) Original scanned record (Right) After Enhancement



Threshold Enhancement

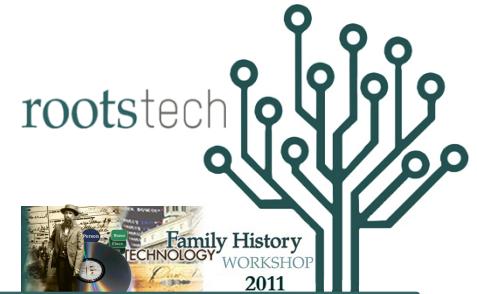
Miller, Riley A.	Miller, Riley
Moore, Elizabeth J.	Moore, Elizabeth J.
Moore, Ira S.	Moore, Ira S.
Moore, Wm.	Moore, Wm.
Mosier, Infant Son	Mosier, Infant Son
Mosier, Beryl	Mosier, Beryl
Mosier, James R.	Mosier, James R.
Mosier, Jessie B.	Mosier, Jessie B.
Mosier, Rebecca Christie	Mosier, Rebecca Christie
Mosier, Susan	Mosier, Susan
Mosier, Thomas F.	Mosier, Thomas F.
Mosier, Warren Leo	Mosier, Warren Leo

(Left) Original scanned record (Right) After thresholding for Bleed-through removal, with Enhancement, and Antialiasing

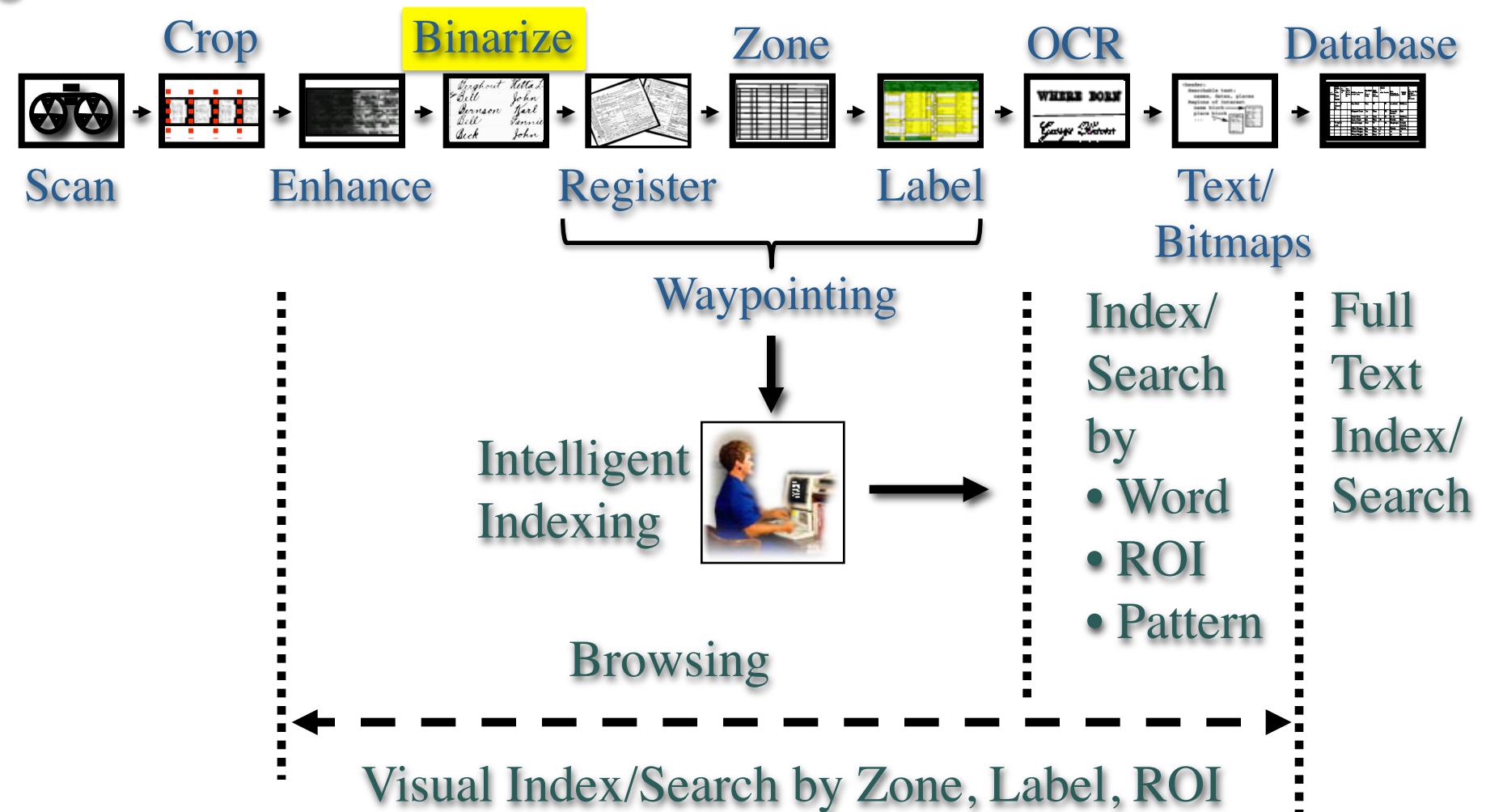
Stroke Enhancement



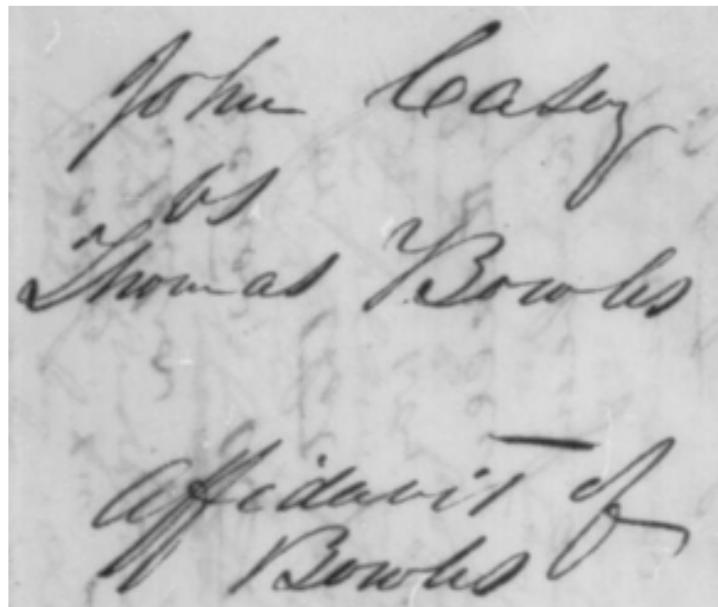
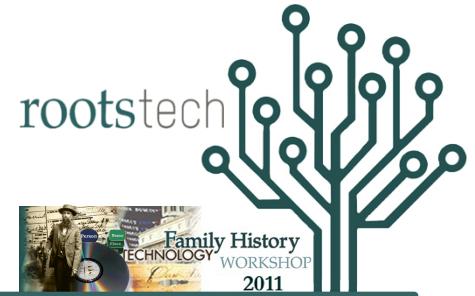
(Left) Original scanned record (Right) After
Matched Filter Stroke Enhancement



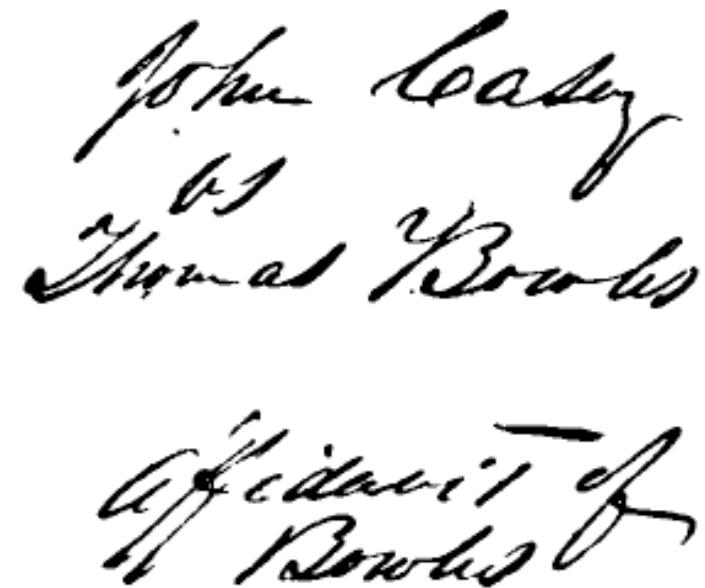
The Digital Microfilm Pipeline



Binarization



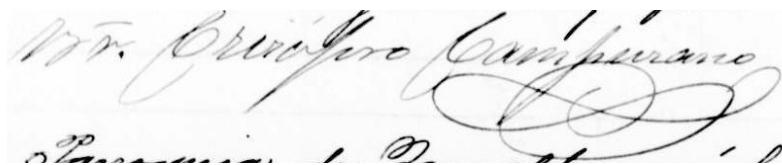
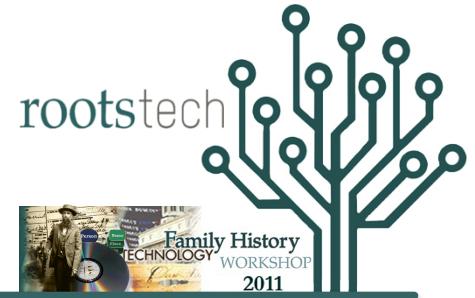
(a) Original Image



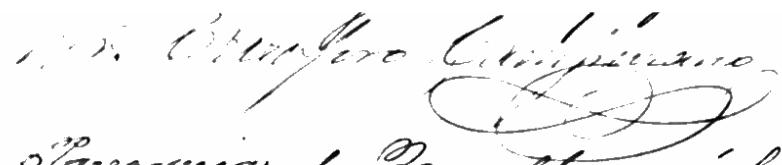
(b) Binarized Result

Median Filter Subtraction for background elimination

Binarization



(a) Original with background removed



(b) First set of text pixels (S_1)



(c) Second set of text pixels (S_2)



(d) Third set of text pixels (S_3)

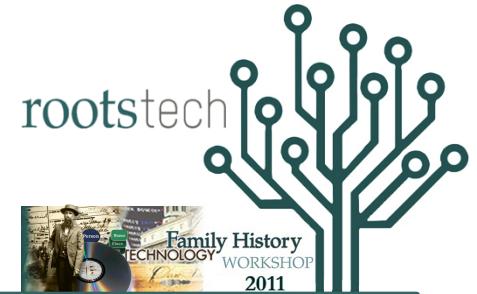


(e) Fourth set of text pixels (S_4)

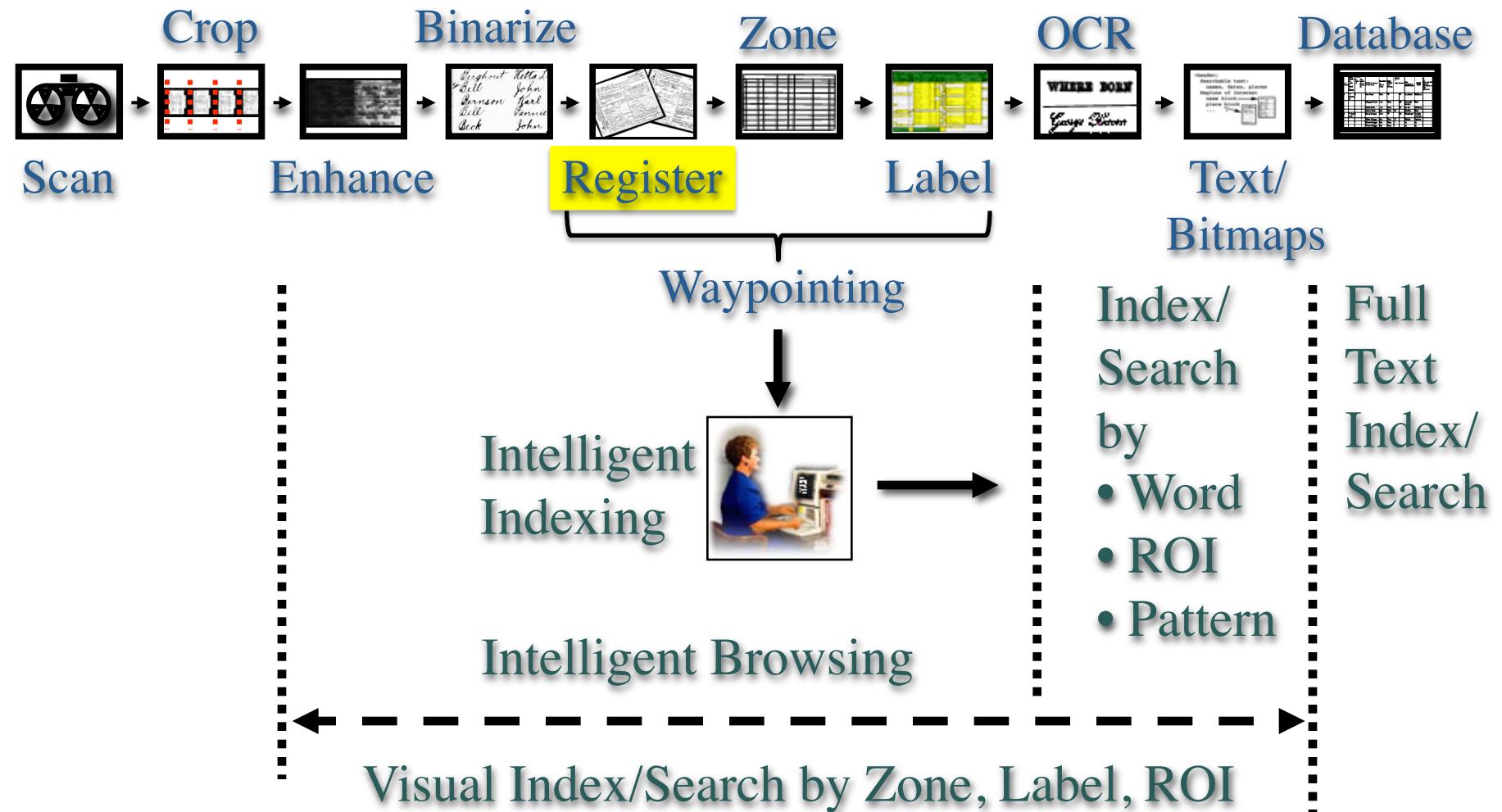


(f) Result ($S_1 + S_2 + S_3 + S_4$)

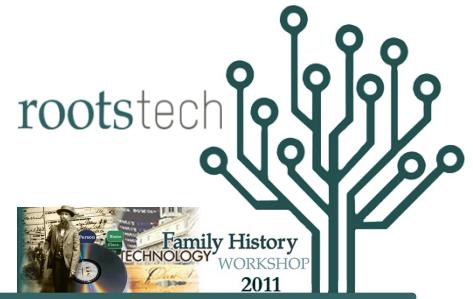
Recursive Otsu Intensity Parsing and Accumulation



The Digital Microfilm Pipeline



Registration



NAME and Surname of each Person	He
Frank Bell Lawrence	C
Mary Ann	-
Carlton A	-
Agnes G	C
John H.	C

+

NAME and Surname of each Person	He
Walter Fawcett	C
Edwin	d
Mark Farmer	C
Amelia d -	C

+

NAME and Surname of each Person	He
William Fawcett	C
Anne d -	C
Albert d	C
John Ferguson	C
Amelia d -	C
Mal	C

=

NAME and Surname of each Person	He
Walter Fawcett	C
Edwin	d
Mark Farmer	C
Amelia d -	C
Mal	C

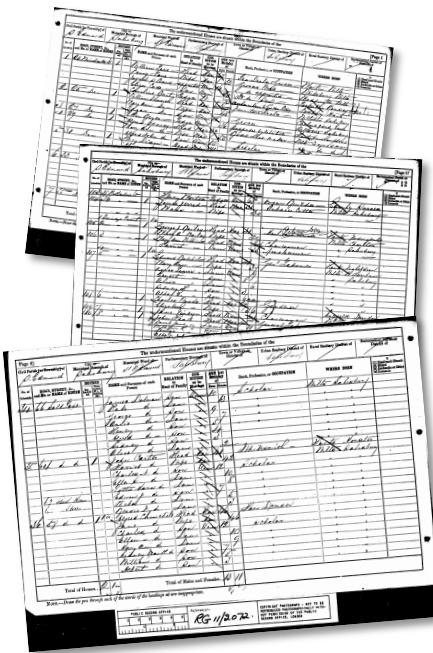
Not registered

NAME and Surname of each Person	He
Walter Fawcett	C
Edwin	d
Mark Farmer	C
Amelia d -	C
Mal	C

Registered

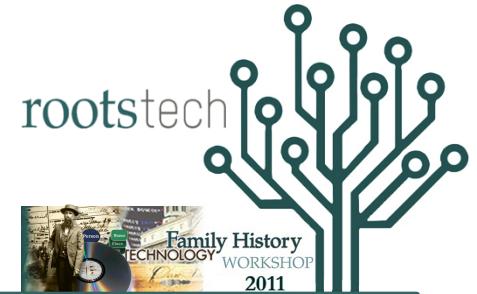
Documents must be aligned, rotated and scaled to register them

Registration

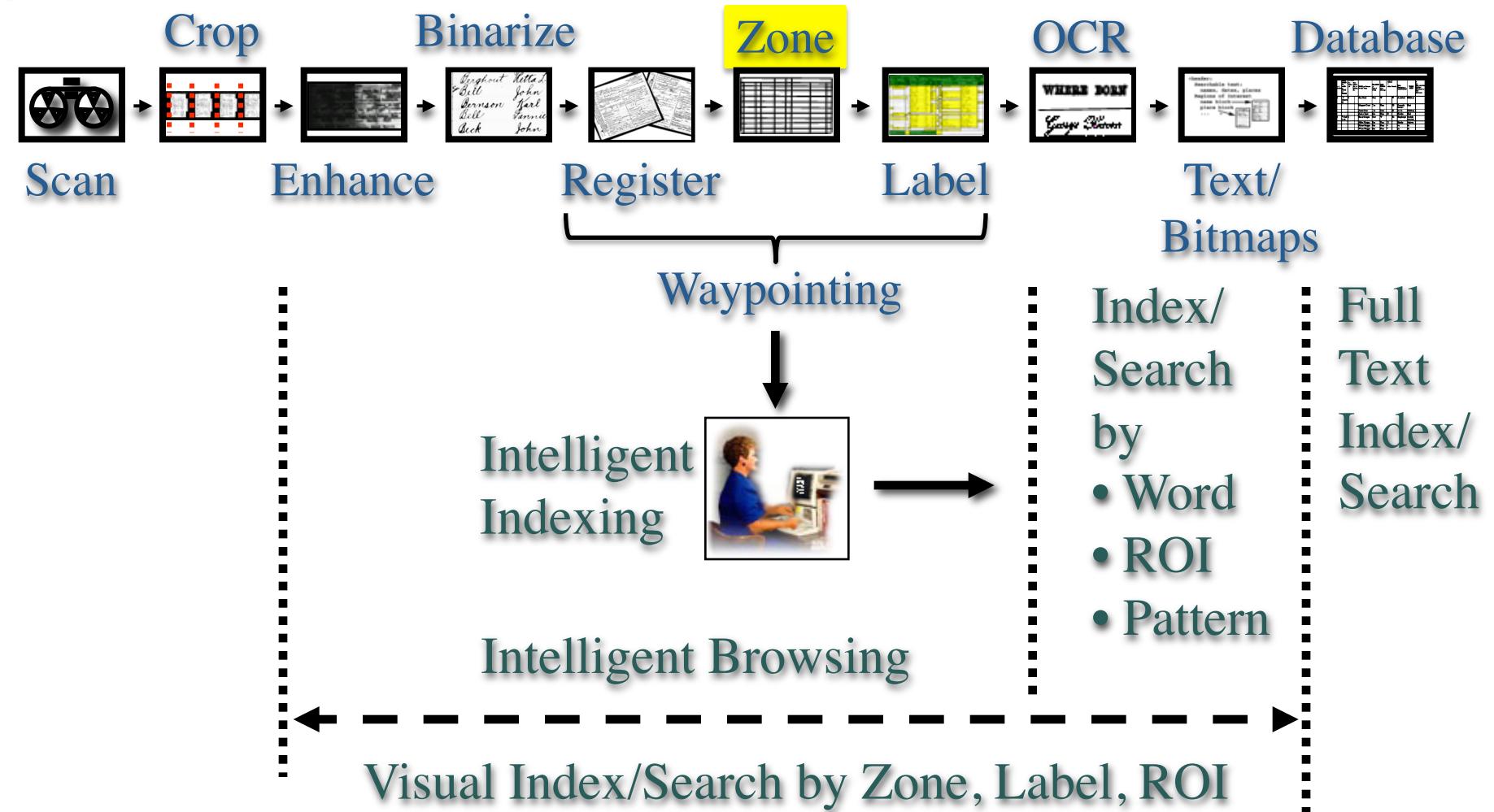


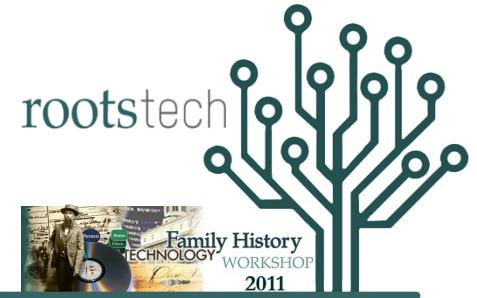
Register

Alignment, rotation and scaling using the Fourier-Mellin Transform allows registration to sub-degree and sub-pixel accuracy.



The Digital Microfilm Pipeline

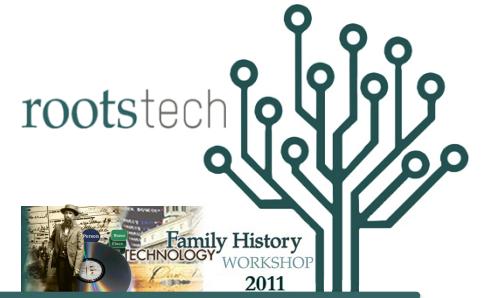




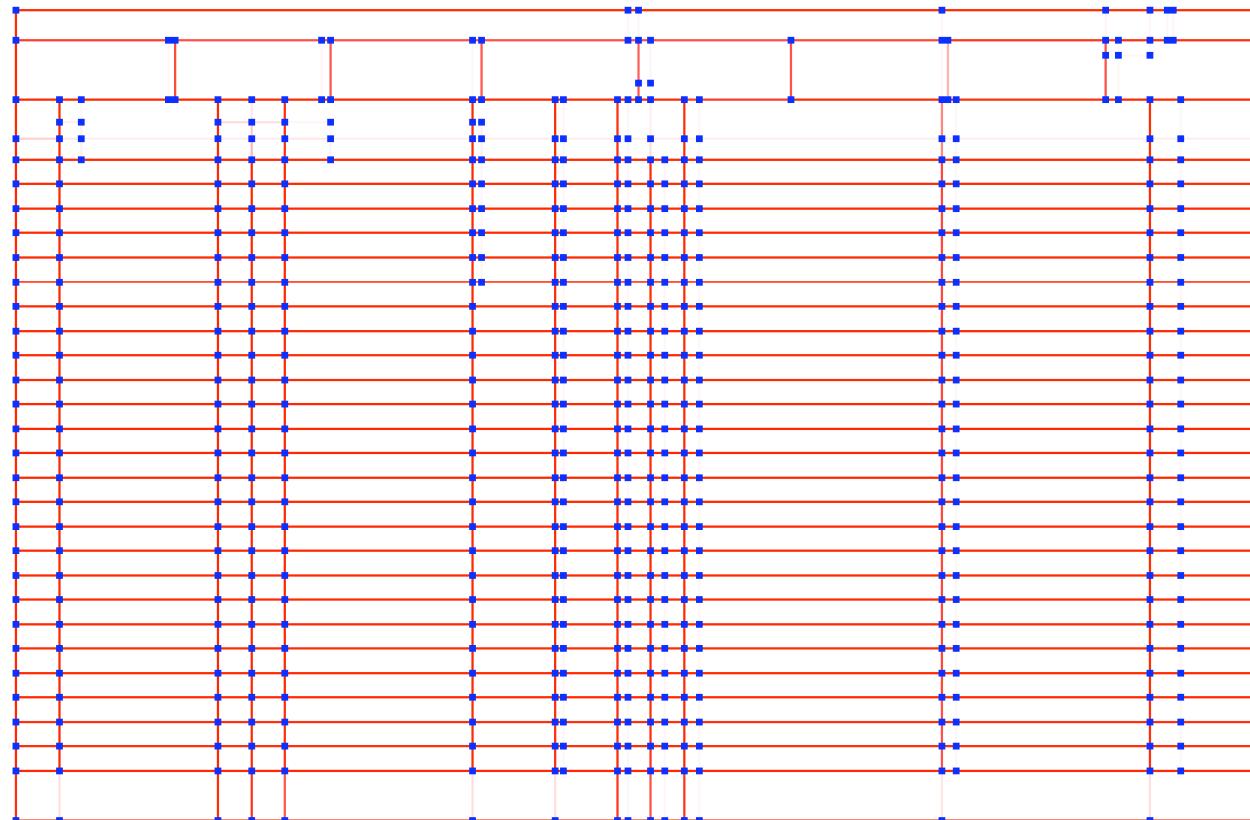
Zoning

Page 2] The undermentioned Houses are situate within the Boundaries of the

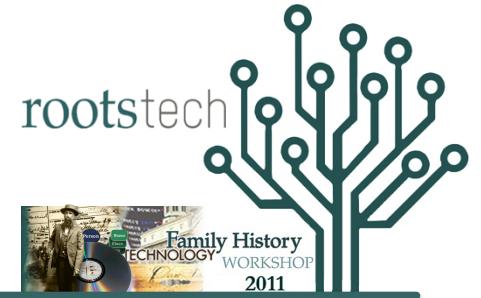
Civil Parish [or Township] of	City or Municipal Borough of	Municipal Ward of	Parliamentary Borough of	Town or Village or Hamlet of	Urban Sanitary District of	Rural Sanitary District of	Ecclesiastical Parish or District of		
No. of Schedule	ROAD, STREET, &c., and No. or NAME of HOUSE	HOUSES 1 or more dwelling houses (B)	NAME and Surname of each Person	RELATION to Head of Family	CON- DITI- ON as to Marriage	AGE last Birthday of Male Person	Rank, Profession, or OCCUPATION	WHERE BORN	II (1) Deaf-and-Dumb (2) Blind (3) Imbecile or Idiot (4) Lunatic
8	Chelwood	1	Charles Hollaway Head M	Son	X	Jan 1864	Stonemason	St Chelwood	
	9	1	John Hollaway Head M	Son	X	Aug 1864	Stonemason	St Chelwood	
	10	1	Eliza d	Wife	M	20	Wife	St Chelwood	
	11	1	John d	Son	M	18	Stonemason	St Chelwood	
	12	1	Charlotte d	Daughter	M	18	Stonemason	St Chelwood	
	13	1	Thomas d	Son	M	18	Stonemason	St Chelwood	
	14	1	James d	Son	M	18	Stonemason	St Chelwood	
	15	1	Eliza d	Daughter	M	18	Stonemason	St Chelwood	
	16	1	John d	Son	M	18	Stonemason	St Chelwood	
	17	1	John d	Son	M	18	Stonemason	St Chelwood	
	18	1	Eliza d	Daughter	M	18	Stonemason	St Chelwood	
	19	1	John d	Son	M	18	Stonemason	St Chelwood	
	20	1	John d	Son	M	18	Stonemason	St Chelwood	
	21	1	John d	Son	M	18	Stonemason	St Chelwood	
	22	1	John d	Son	M	18	Stonemason	St Chelwood	
	23	1	John d	Son	M	18	Stonemason	St Chelwood	
	24	1	John d	Son	M	18	Stonemason	St Chelwood	
	25	1	John d	Son	M	18	Stonemason	St Chelwood	
	26	1	John d	Son	M	18	Stonemason	St Chelwood	
	27	1	John d	Son	M	18	Stonemason	St Chelwood	
	28	1	John d	Son	M	18	Stonemason	St Chelwood	
	29	1	John d	Son	M	18	Stonemason	St Chelwood	
	30	1	John d	Son	M	18	Stonemason	St Chelwood	
	31	1	John d	Son	M	18	Stonemason	St Chelwood	
	32	1	John d	Son	M	18	Stonemason	St Chelwood	
	33	1	John d	Son	M	18	Stonemason	St Chelwood	
	34	1	John d	Son	M	18	Stonemason	St Chelwood	
	35	1	John d	Son	M	18	Stonemason	St Chelwood	
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	39	1	John d	Son	M	18	Stonemason	St Chelwood	
	40	1	John d	Son	M	18	Stonemason	St Chelwood	
	41	1	John d	Son	M	18	Stonemason	St Chelwood	
	42	1	John d	Son	M	18	Stonemason	St Chelwood	
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	46	1	John d	Son	M	18	Stonemason	St Chelwood	
	47	1	John d	Son	M	18	Stonemason	St Chelwood	
	48	1	John d	Son	M	18	Stonemason	St Chelwood	
	49	1	John d	Son	M	18	Stonemason	St Chelwood	
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	149	1	John d	Son	M	18	Stonemason	St Chelwood	
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	151	1	John d	Son	M	18	Stonemason	St Chelwood	
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	156	1	John d	Son	M	18	Stonemason	St Chelwood	
	157	1	John d	Son	M	18	Stonemason	St Chelwood	
	158	1	John d	Son	M	18	Stonemason	St Chelwood	
	159	1	John d						



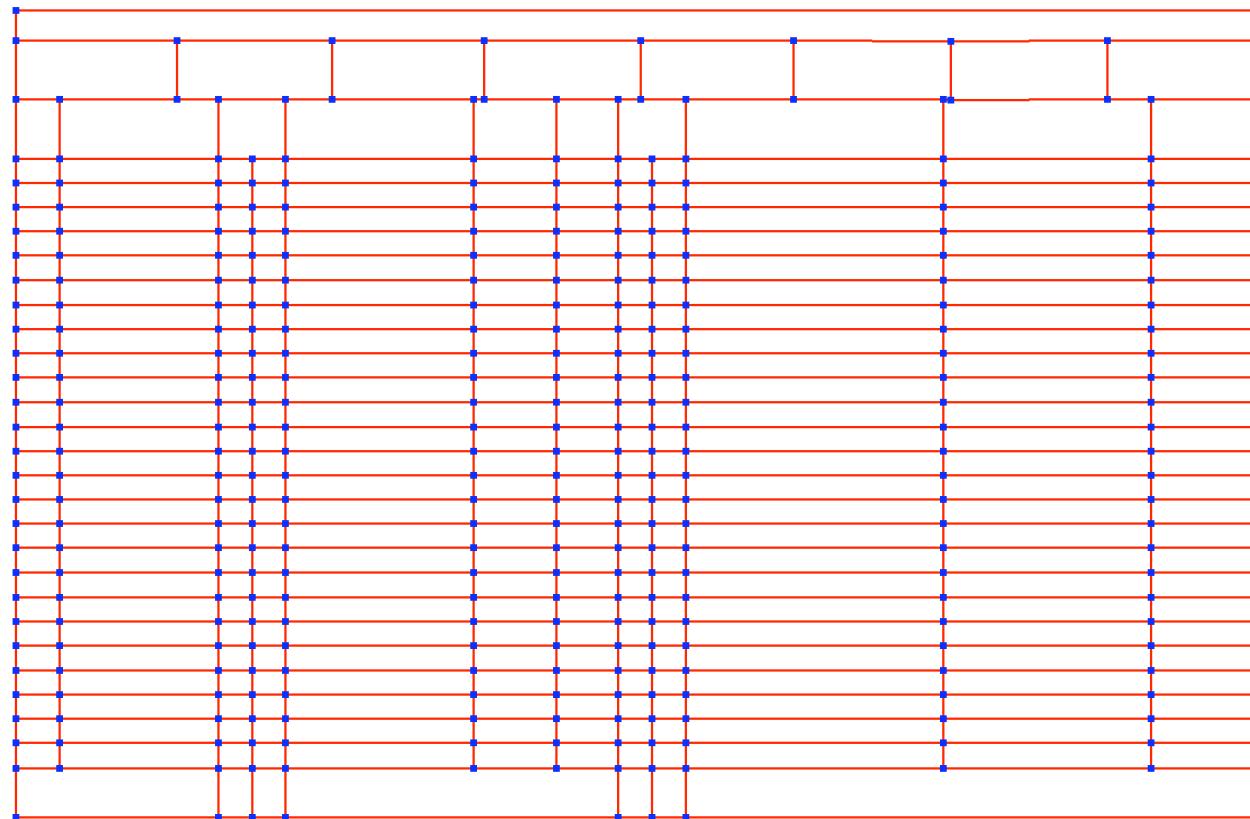
Zoning by Consensus



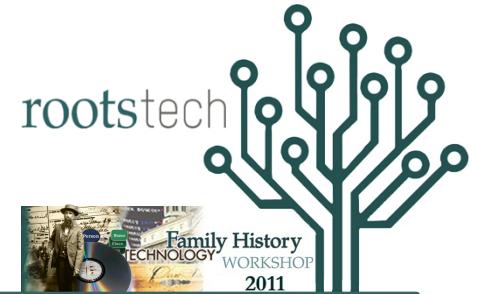
Consensus from 28 frames



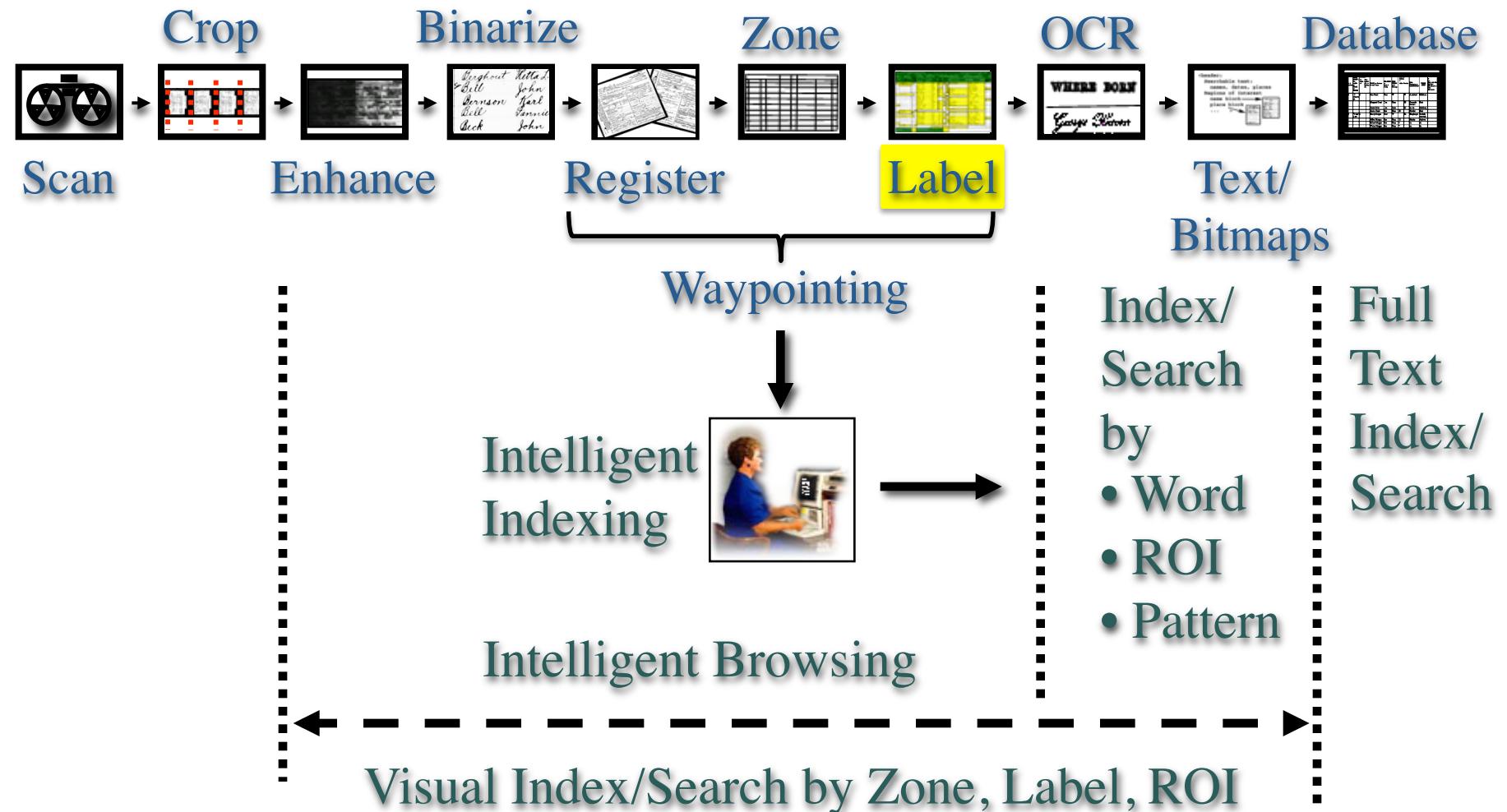
Zoning by Consensus



Final Zone Template



The Digital Microfilm Pipeline



Label Machine Print

The undenominated Boxes are those within the boundaries of the											
First Name or Surname of	Middle Name or Initials of	Married Name of	Parishioner Registered	Date of Birth	Urban Registry Number of	Residuary Number of	Residence Number of	Residence Street or Road	Residence Number of	Residence Street or Road	Residence Number of
<i>J. Edward</i>	<i>John</i>	<i>Johnson</i>	<i>Johnson</i>	<i>July</i>	<i>1880</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>
MALE STREET	NUMBER	NAME and Number of each Person	RELATION	SEX	AGE	SEX	AGE	SEX	AGE	SEX	AGE
10	10	10	10	10	10	10	10	10	10	10	10
Back Production, or REPRODUCTION											
WHERE BORN											
Page 1											

The undenominated Boxes are those within the boundaries of the											
First Name or Surname of	Middle Name or Initials of	Married Name of	Parishioner Registered	Date of Birth	Urban Registry Number of	Residuary Number of	Residence Number of	Residence Street or Road	Residence Number of	Residence Street or Road	Residence Number of
<i>J. Edward</i>	<i>John</i>	<i>Johnson</i>	<i>Johnson</i>	<i>July</i>	<i>1880</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>
MALE STREET	NUMBER	NAME and Number of each Person	RELATION	SEX	AGE	SEX	AGE	SEX	AGE	SEX	AGE
10	10	10	10	10	10	10	10	10	10	10	10
Back Production, or REPRODUCTION											
WHERE BORN											
Page 2											

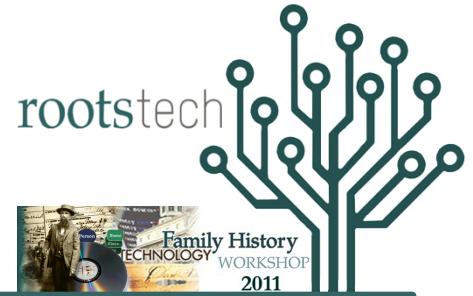
The undenominated Boxes are those within the boundaries of the											
First Name or Surname of	Middle Name or Initials of	Married Name of	Parishioner Registered	Date of Birth	Urban Registry Number of	Residuary Number of	Residence Number of	Residence Street or Road	Residence Number of	Residence Street or Road	Residence Number of
<i>J. Edward</i>	<i>John</i>	<i>Johnson</i>	<i>Johnson</i>	<i>July</i>	<i>1880</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>	<i>10</i>
MALE STREET	NUMBER	NAME and Number of each Person	RELATION	SEX	AGE	SEX	AGE	SEX	AGE	SEX	AGE
10	10	10	10	10	10	10	10	10	10	10	10
Back Production, or REPRODUCTION											
WHERE BORN											
Page 3											

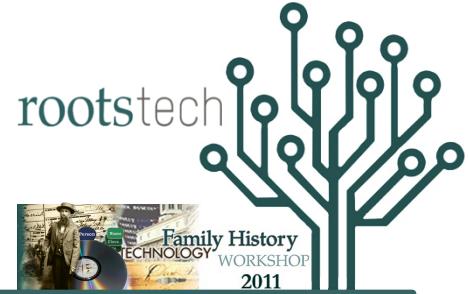
WHERE BORN

WHERE BORN

WHERE BORN

Label Handwriting



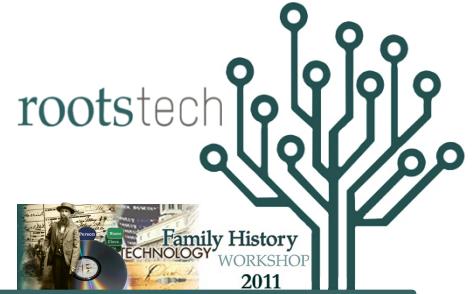


Labeled Image

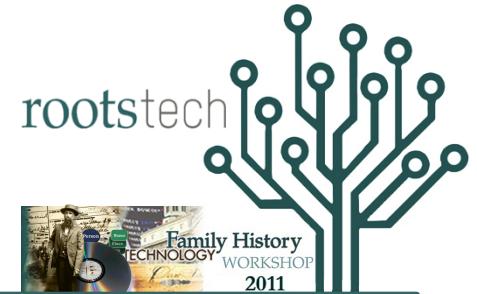
[Example]

The undermentioned Houses are situate within the Boundaries of the								18	
Civil Parish for Township of St. Mary.	City or Municipal Borough of Shrewsbury.	Municipal Ward of Welsh.	Parliamentary Borough of Shrewsbury.	Town or Village or Hamlet of	Urban Sanitary District of Shrewsbury.	Rural Sanitary District of	Ecclesiastical Parish or District of St. Michael.		
No. of Schedule	ROAD, STREET, &c., and No. or NAME of HOUSE	HOUSES In Unin- habited or Building (B.)	NAME and Surname of each Person	RELATION to Head of Family	CON- DICTION as to Marriage	AGE last Birthday of Males Females	Rank, Profession, or OCCUPATION	WHERE BORN	(1) Deaf & Dumb (2) Blind (Idiot) (3) Imbecile or (4) Lunatic
4	7, Charlotte St. ("Queen's Arms")	1	Michael Morrison Mary J. Do. Ellen Do. Elizabeth Morrison Ann Fox Catherine Doyle	Head Wife Daur. Mother Serv. Serv.	Mar. Mar. Mar. W. Unm. Unm.	31 29 Jno 58 28 24	Licensed Victualler General Serv. Annuitant General Serv. Waitress	Middlesex; Islington Salop; Condover Salop; Shrewsbury Salop; Shrewsbury Gants; Andover Fieland	
5	8, Charlotte St.	1	Lambert Weston Emma Do. William Do. Henrietta Do. George Bacon Jane Cook James F. Phillips Harriet Do. Sophia White	Head Wife Son Daiz. Shopman Serv. Head Wife Serv.	Mar. Mar. Mar. Mar. Unm. Unm. Mar. Mar. Unm.	39 36 12 9 19 22 41 29 16	Grocer; (master, employing 2 men) Scholar Do. Grocer's Shopman General Serv. Banker's Clerk General Serv.	Cumberland; Wigton Do.; Longdown Salop; Ludlow Do.; Do. Middlesex; Shoreditch Scotland Yorkshire; Leeds Do.; Bradford Salop; Bridgenorth	
6	9, Do.	196							
7	1, Bird Lane	1	William Tampion Anne Do. Thomas Johnson Henry Johnson Emma Do. Jane Tampion Walter Campbell	Head Wife Head Son Serv. Apprentice Lodger	Mar. Mar. Wid. Unm. Unm. Unm. Unm.	79 69 68 39 41 18 23	Coach Turner Peculiar Grocer Organist Ceset Makers Ceset Makers (Apprentice) Ship Carpenter (out of employ)	Suffolk; Bosten Do.; Tamworth Devon; Exoniton Salop; Shrewsbury Middlesex; St. Pancras Salop; Ludlow Durham; Sunderland	
8	2, Bird Lane	1							
9	Do.	22							
Total of Houses...		196	Total of Males and Females...		9	13			
End of St. Michael Ecclesiastical District									

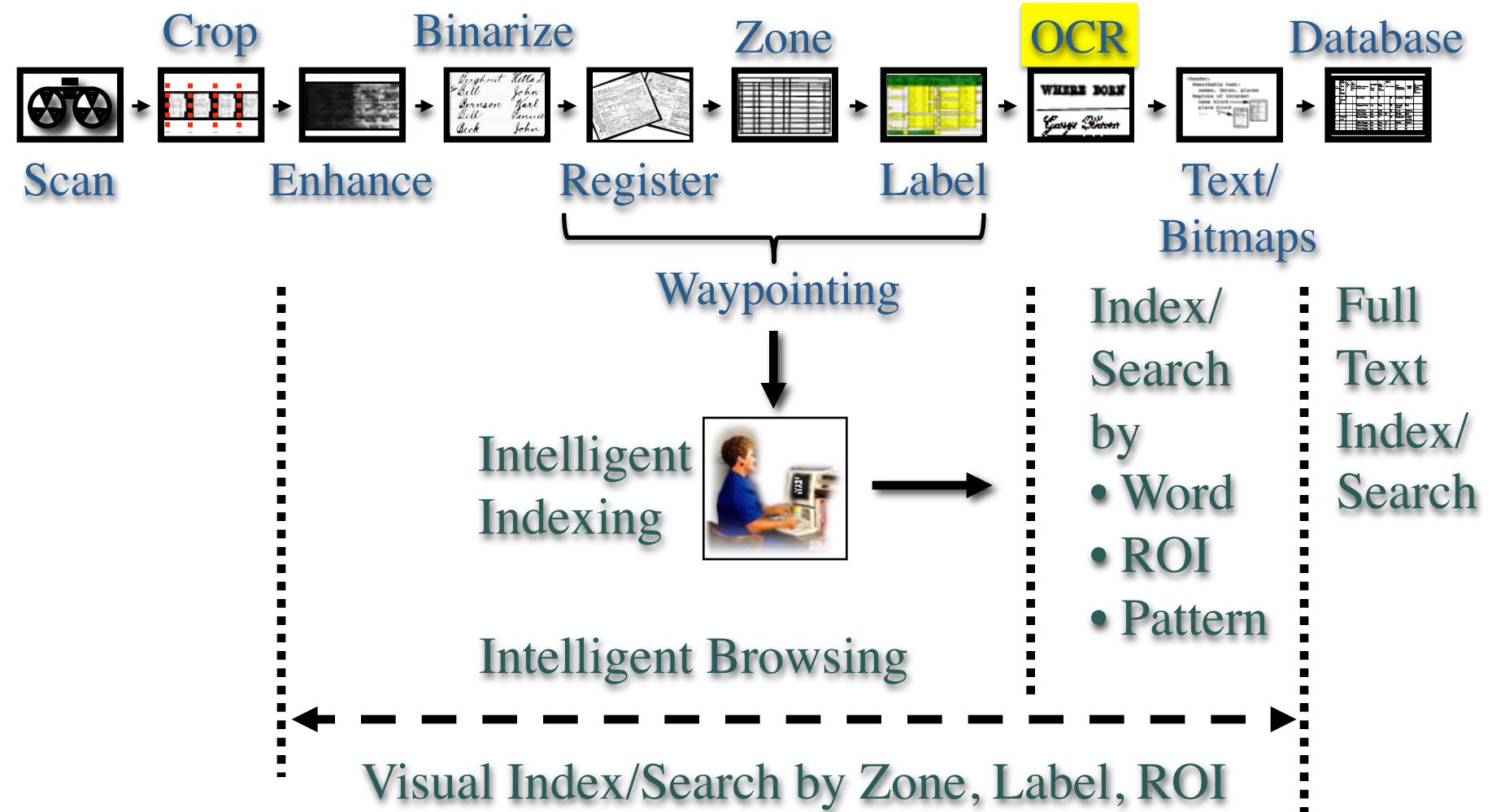
PUBLIC RECORD OFFICE						Reference:-	COPYRIGHT PHOTOGRAPH - NOT TO BE REPRODUCED PHOTOGRAPHICALLY WITHOUT PERMISSION OF THE PUBLIC RECORD OFFICE, LONDON		
1	2	3	4	5	6		RG 11/2072.		
1			2						



Zoned and Labeled Image



The Digital Microfilm Pipeline



Machine-Printed OCR

A solved problem?

NAME and Surname of each Person			
Street, Avenue, Road, etc.	House number (in cities or towns)	Number of dwelling houses in order of visitation	Number of family in order of visitation
		1	2

Archivo de la Parroquia
 SANTA MARIA de I., LAYLOS
 JALISCO
BAUTISMO DE HIJOS LEGITIMOS
VOLUMEN NUM. 104 1897 1899

Academia Mexicana de Genealogía y Heráldica

Revisor: Fecha: 11/1

LOCATION.		NAME	RELATION.
IN CITIES.		of each person whose place of abode on June 1, 1900, was in this family.	Relationship of each person to the head of the family.
Street.	House Number.	Enter surname first, then the given name and middle initial, if any.	
	1	INCLUDE every person living on June 1, 1900. OMIT children born since June 1, 1900. <i>Anthony Lucas family</i> <i>3 boy over from Shrub</i>	4
	2		

FILMADO POR LA SOCIEDAD GENEALÓGICA
PARROQUIA DE SANTIAGO
TEMAPACHE VER. DIOCESIS
DE TUXPAM VER. MEX.

EN MEXICO

ITEM 1

LOCALIDAD QUE CORRE EL REGISTRO

TIPO DE FILMACION: 15 1984

REDUCCION (X): 40

EXPOSICION: 20

DE EMULSION: 6-452-1

NUMERO DE CAMARA: 51896

O DEL PROYECTO: C-2-059

NUMERO DEL ROLLO: 1

Sort of ... depending on resolution, clarity, noise, etc.

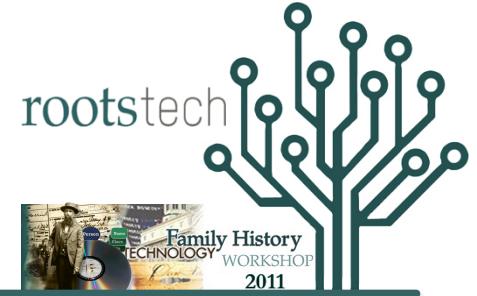


Handwriting Recognition

Definitely *NOT* a solved problem

Cursive, off-line handwriting recognition is an area of active research

Handwriting Recognition Challenges/Opportunities



- Image quality is not always good
 - Fading of documents/acetate-based microfilm
 - Original document written with quill-pen

A photograph of a handwritten signature on lined paper. The signature reads "Agnes E. -" followed by "William Abel" and "Eliza Abel" on the next line, and "Isaac Abel" on the bottom line. The handwriting is cursive and appears to be in ink.

- But documents were usually written meticulously
 - Older handwriting more regular, so simpler to match than modern handwriting
 - Different approach required (e.g. stroke ordering problem)

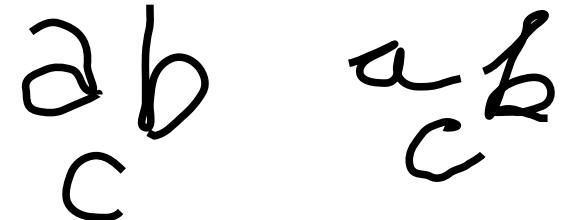
Handwriting Recognition

Past Approaches



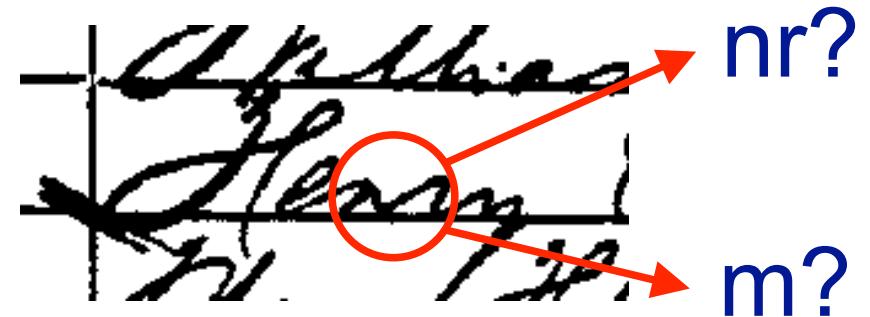
- An example of some steps in the recognition process:

- *Handwriting style clustering*



Two handwritten examples of letter clusters. The first shows 'a b' above 'c'. The second shows 'a b' above 'c' with a horizontal line through it.

- *Letter recognition*



A handwritten signature "John Smith" written twice on a grid. A red circle highlights a portion of the second "S". Red arrows point from this circle to the questions "nr?" and "m?", suggesting uncertainty in letter recognition.

- *Approximate string matching*

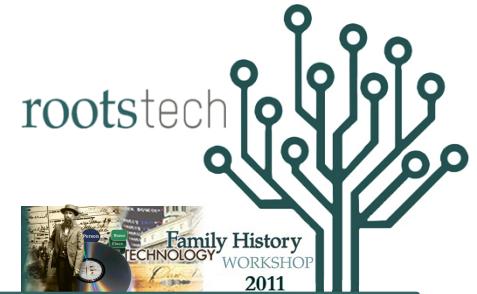
Smith
Smythe

Handwriting Recognition

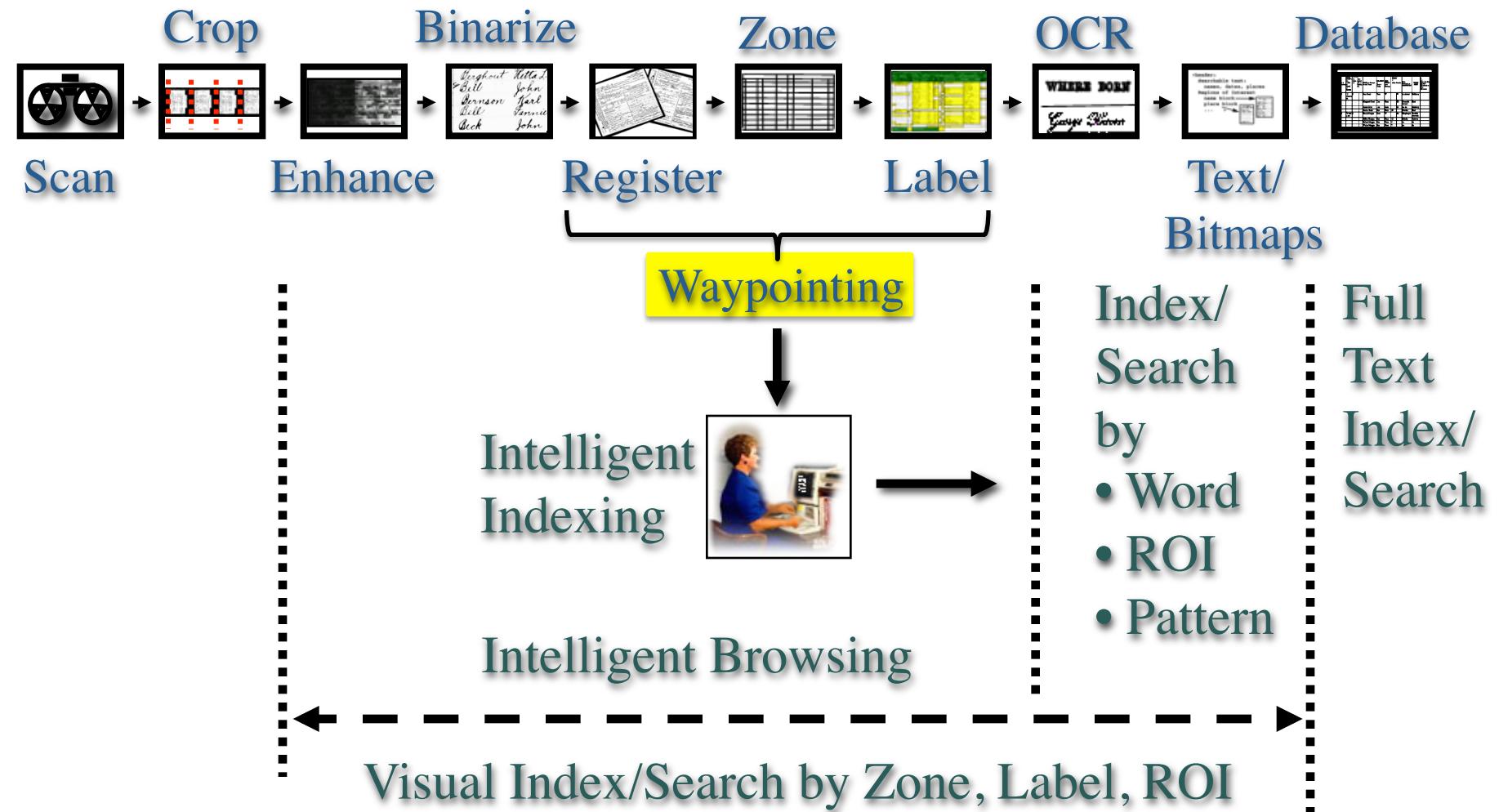
Future Approaches



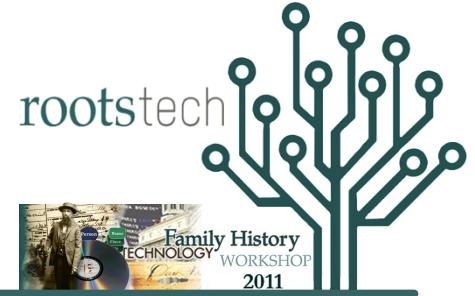
- Exploit manually-indexed, ground-truthed data to train algorithms
- Training may be required for each new handwriting style / time period
- (Semi-) Automated extraction system: Intelligent assistant to indexer, or use as “Indexer B.”
- Use image morphing/pattern recognition: don’t have to recognize explicitly, only implicitly
- Use contextual information to increase confidence



The Digital Microfilm Pipeline

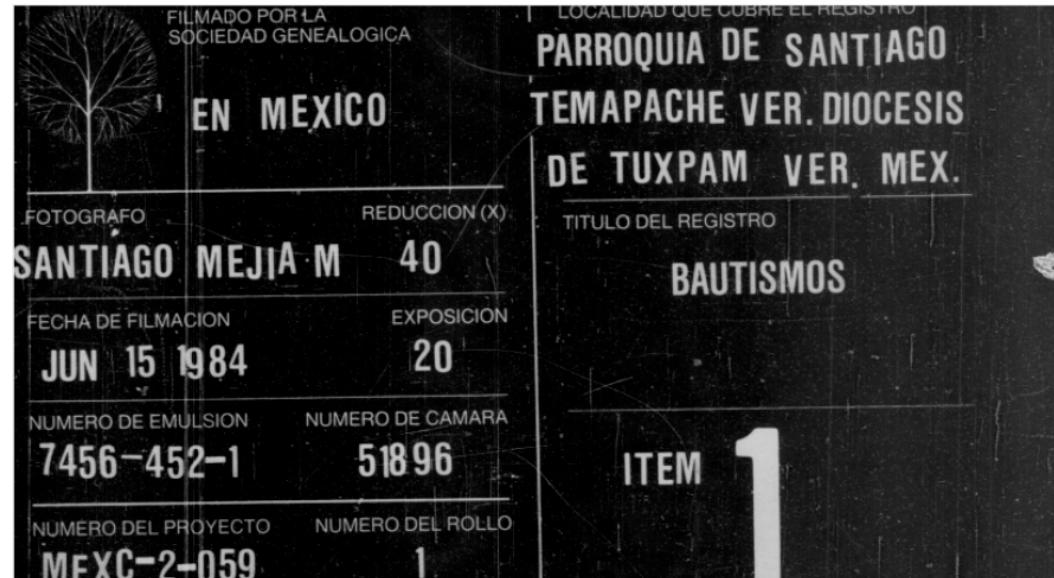


Automated Waypointing: Extract content from titleboards*



Focus on key fields:

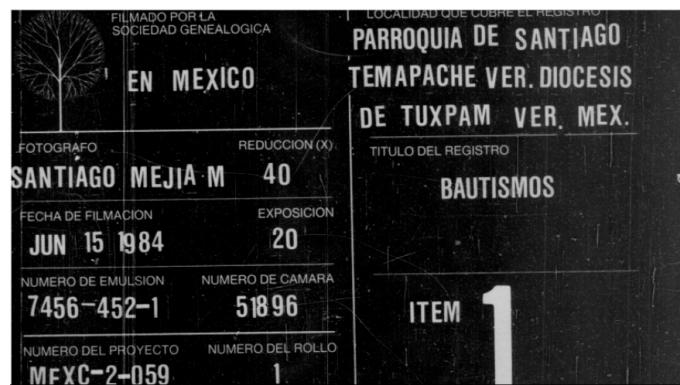
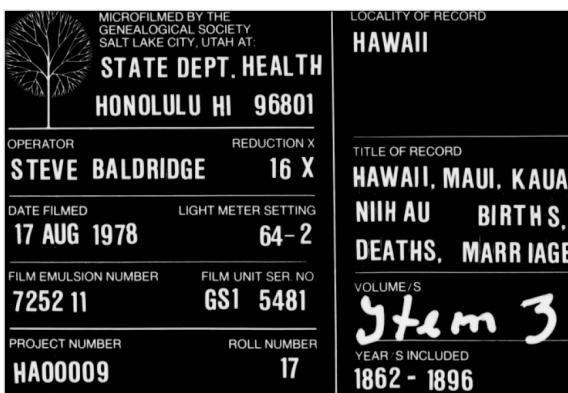
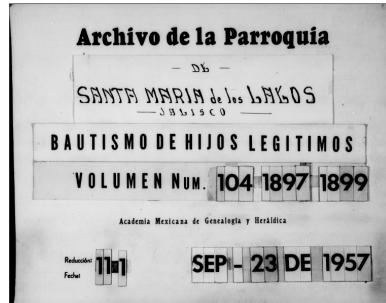
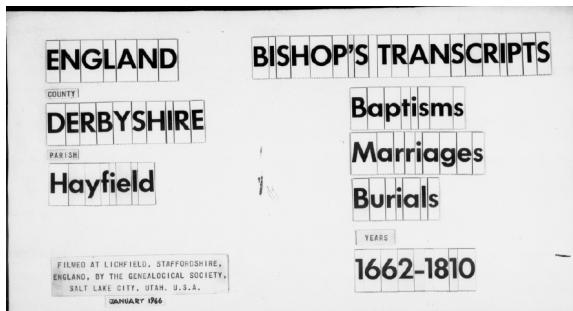
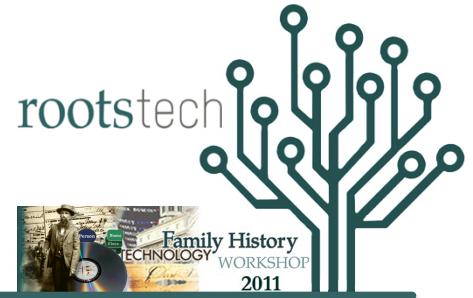
- Record type
- Place
- Date range
- Repository
- Film number



OCR/Index the text

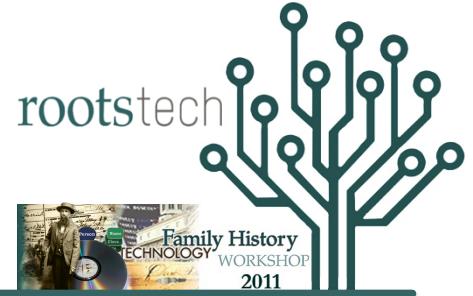
* David Ouimette, Jake
Gehring

Automated Waypointing: Group titleboards uniformly

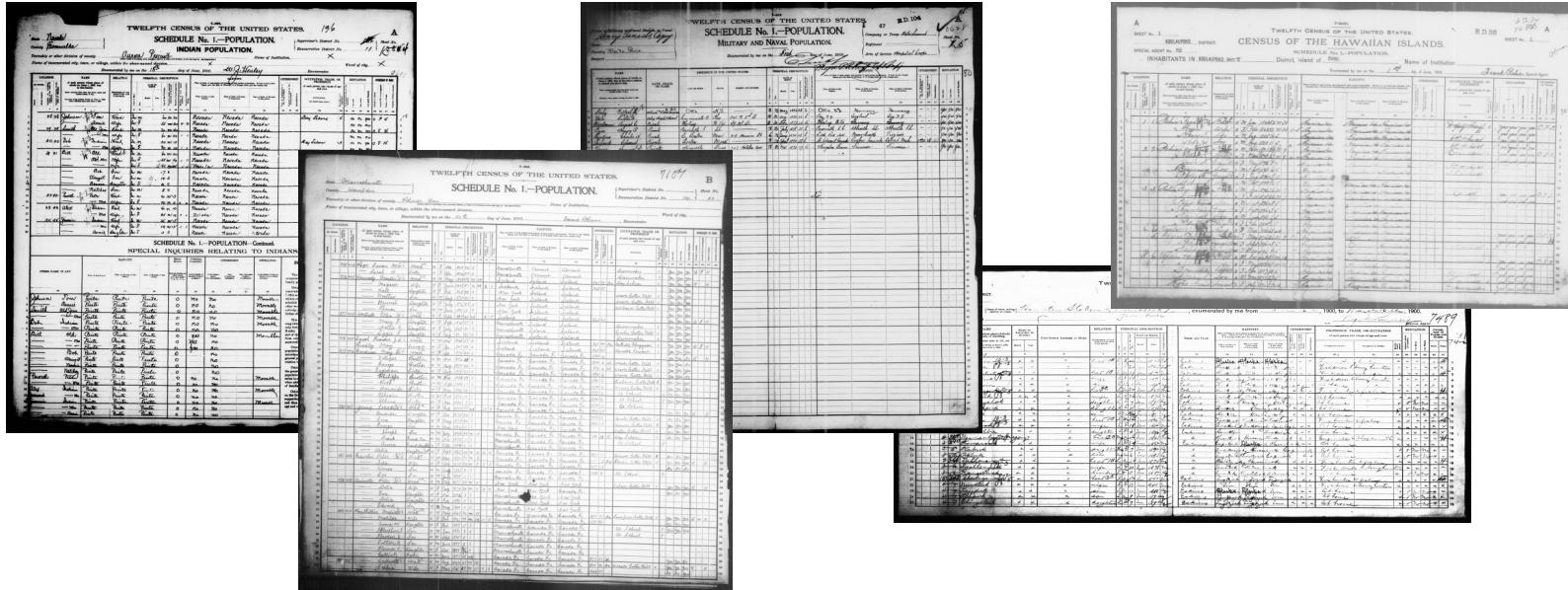


To facilitate collection analysis and indexing prep

Automated Waypointing: Classify images that look alike

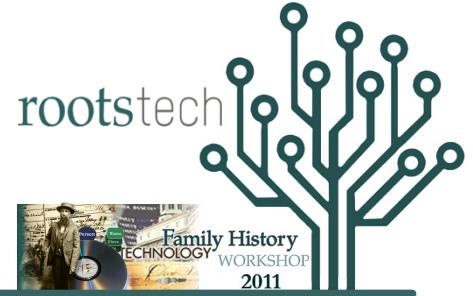


Example 1: There are five distinct forms used in the 1900 census. They need to be treated differently when indexing

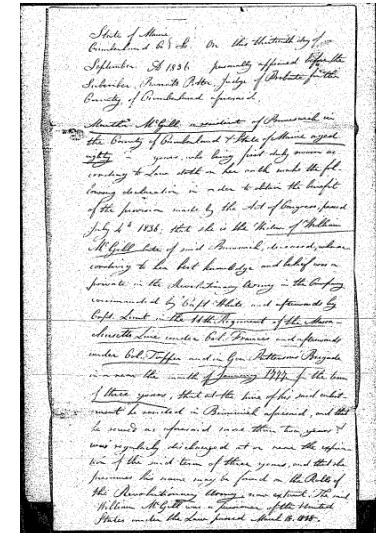
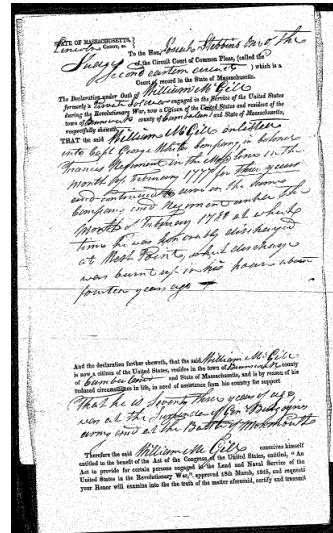
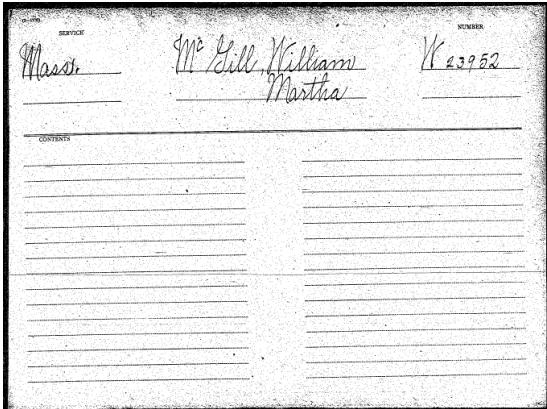


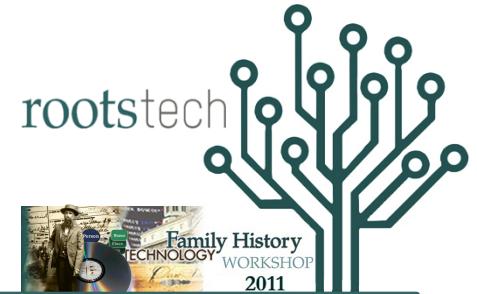
Tool for index batching and automated waypointing

Automated Waypointing: Classify images that look alike

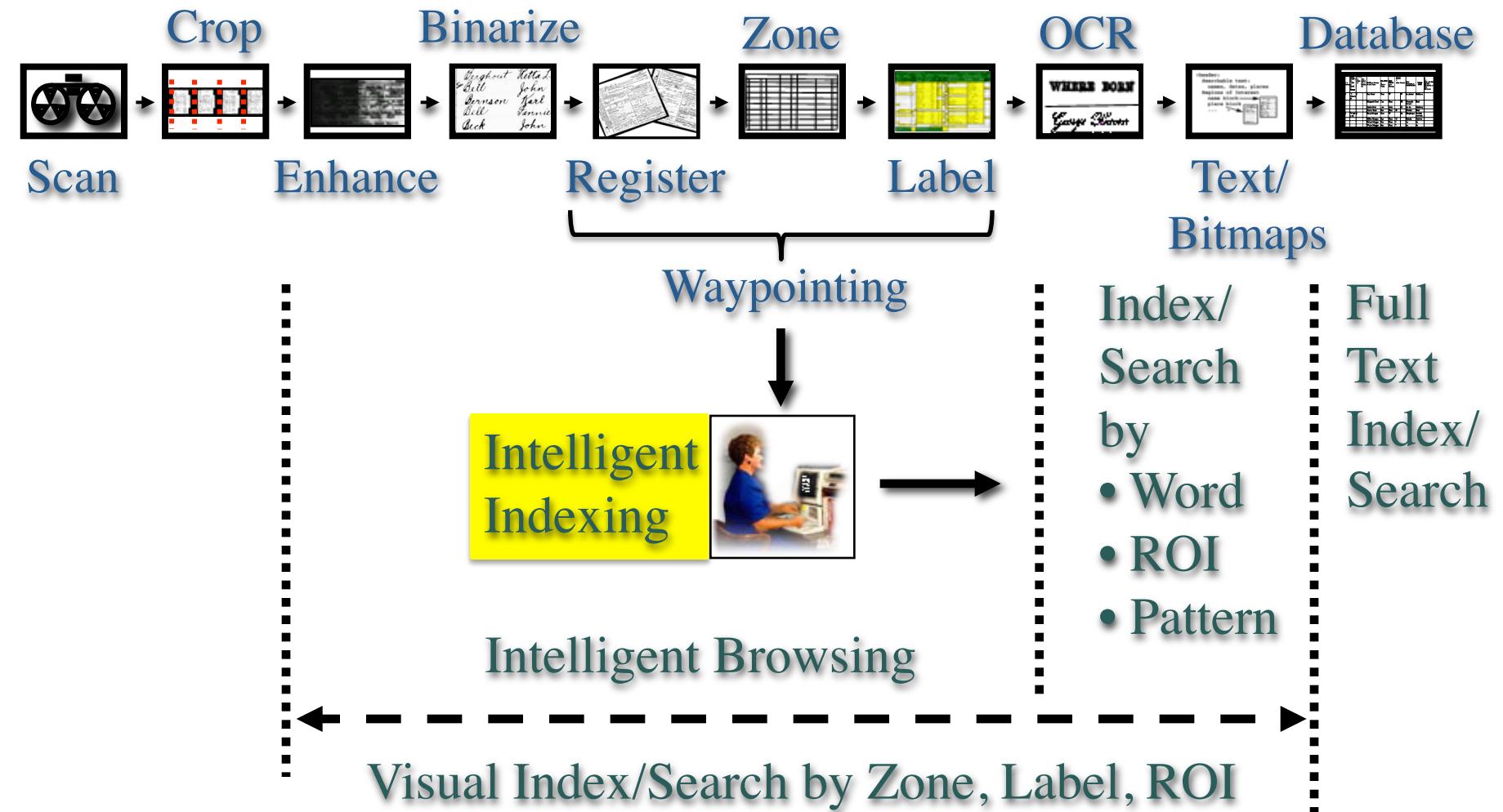


- Tool for waypointing and index batching
- Example 2: Create brief indexes (e.g., Rev War pensions)
 - Isolate images to send to indexers (e.g., a single card image which precedes dozens of pages in a pension packet)
 - Waypoint entire set of images, including indexed images





The Digital Microfilm Pipeline

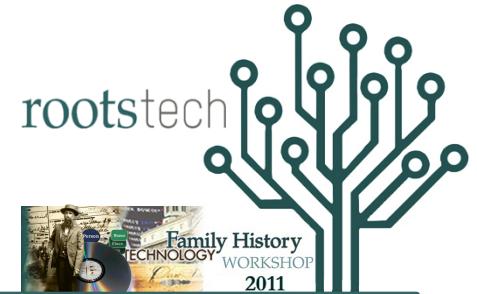


Intelligent Indexing

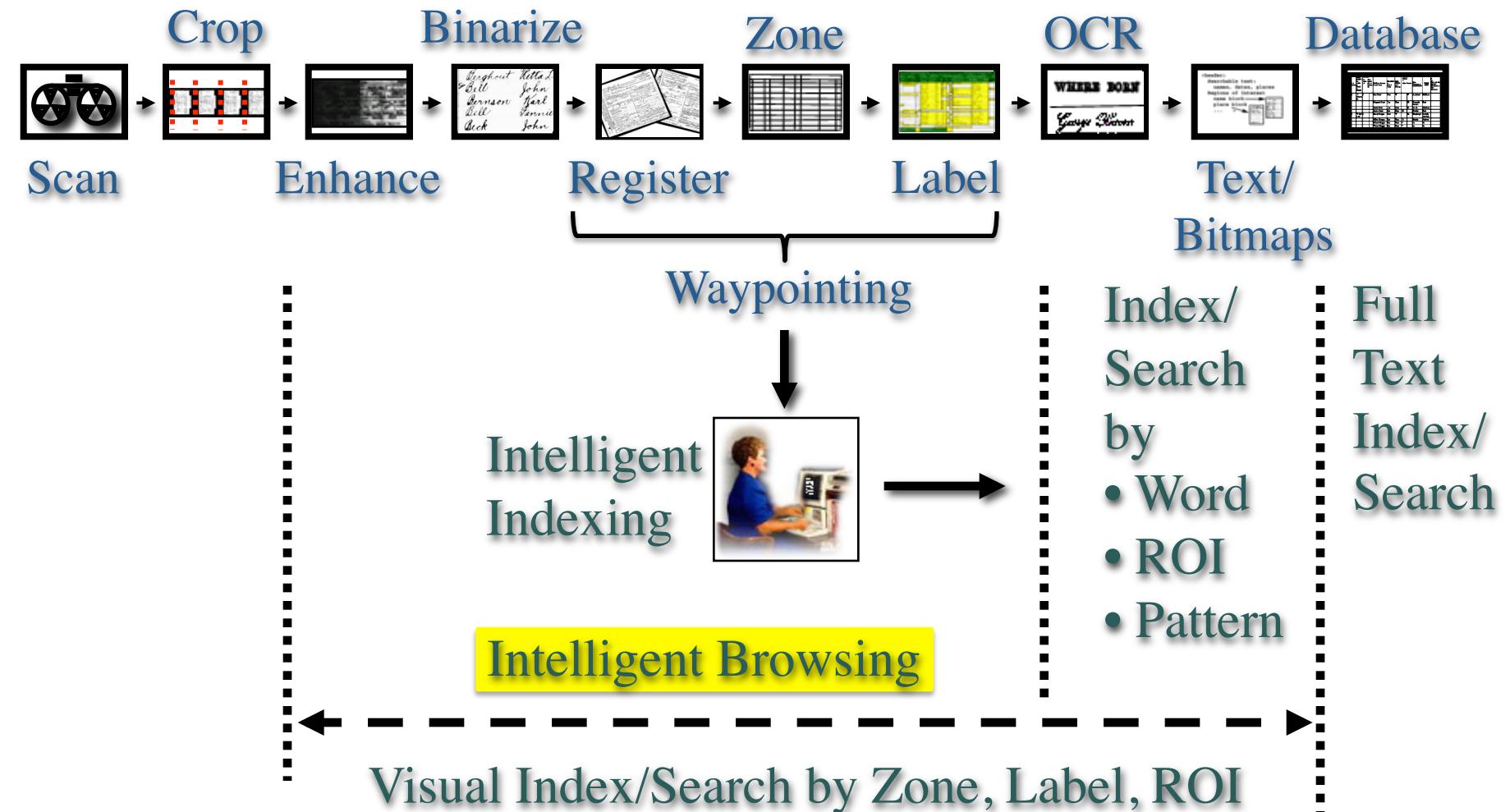


Agent “looking over the shoulder” of the indexer:

- Name glyphs + ground truth = Training Set for recognition algorithms
- Agreement/disagreement with other indexer weights prior/conditional probabilities
- “Remembers” image patterns and characters from previously entered names to prompt indexer and refine probabilities and training set
- Exploits contextual constraints from surrounding data



The Digital Microfilm Pipeline



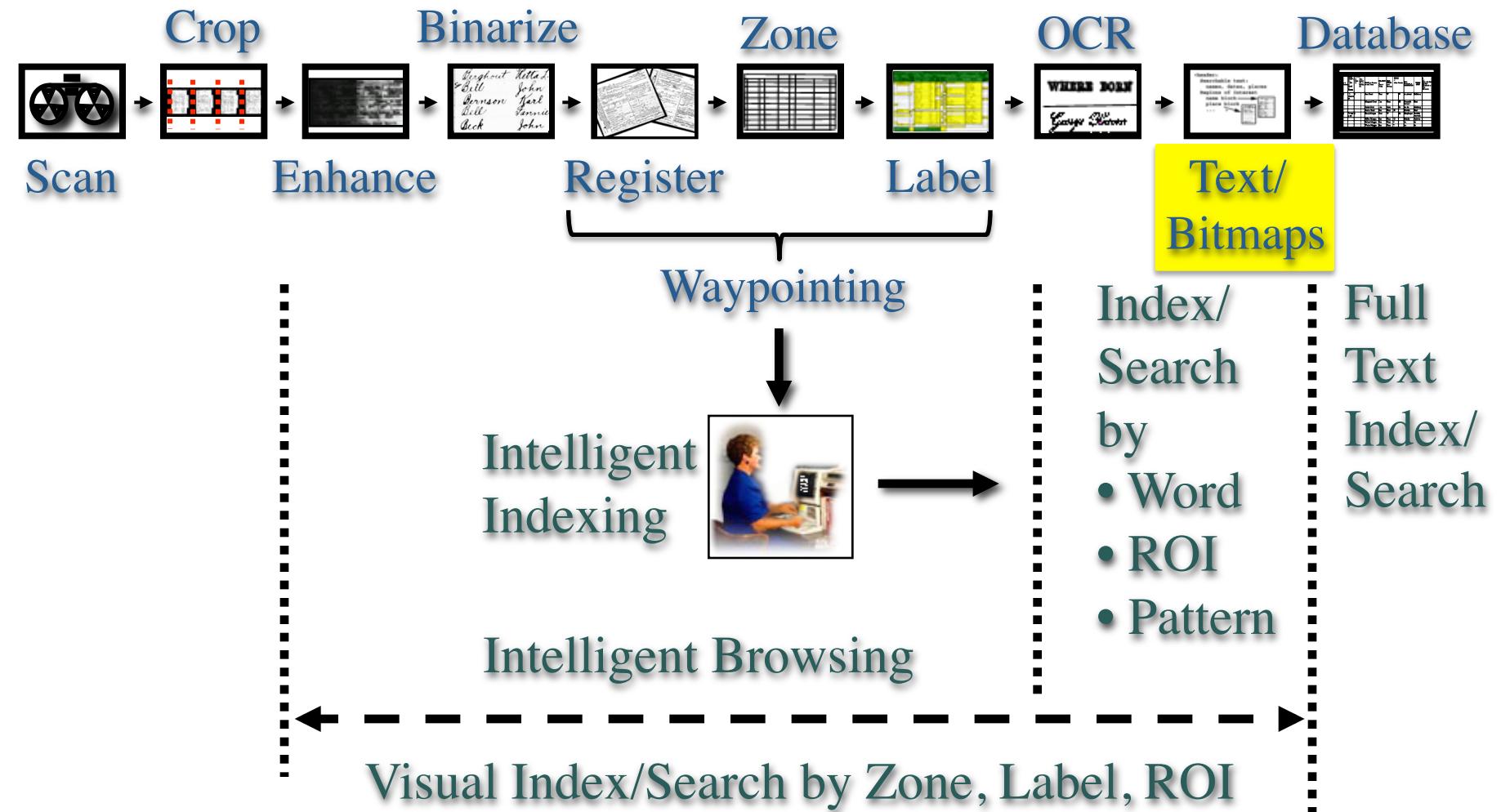
Intelligent Browsing



- Use automated waypointing for light to fine-grained, hierarchical frame to field level **snap-click browsing**
- Capture and “remember” the frames and fields the user is browsing. Ask: **“5 others users have interest in this name – would you like to know who they are?”**
- **“Amazon Browsing:** “Users who looked at this also looked at the following frames/fields/names ...”
- **Hyperlinking of fields** to source data or related information in this or other collections



The Digital Microfilm Pipeline



Search by Words/Patterns

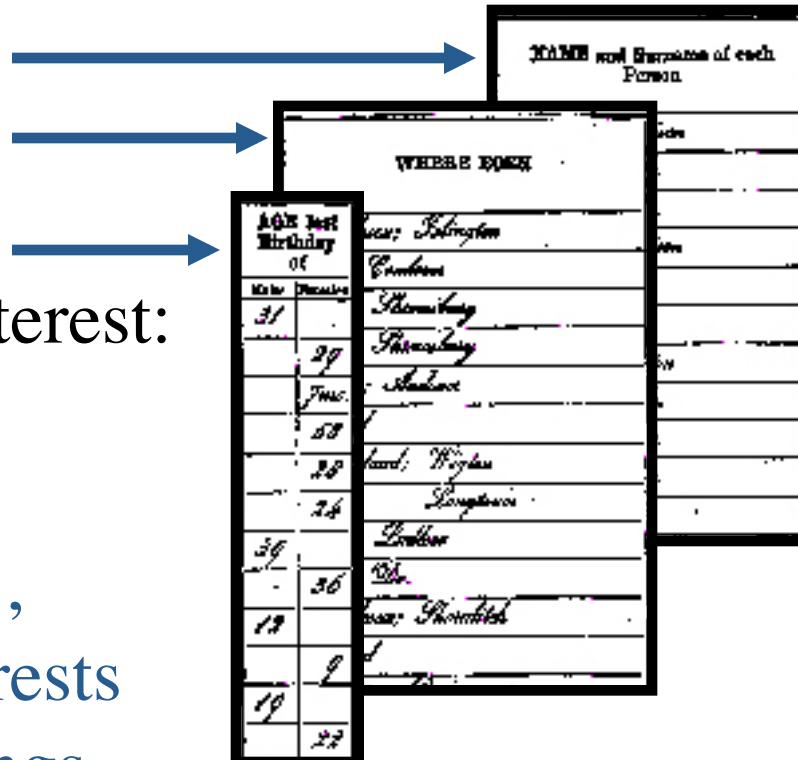
<header:

Name fields

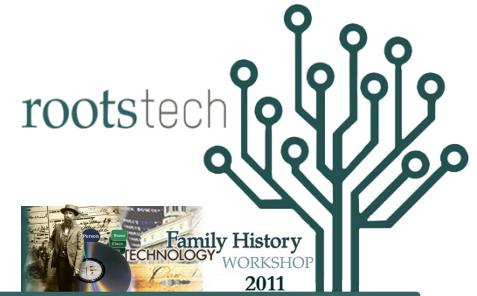
Place fields

Date fields

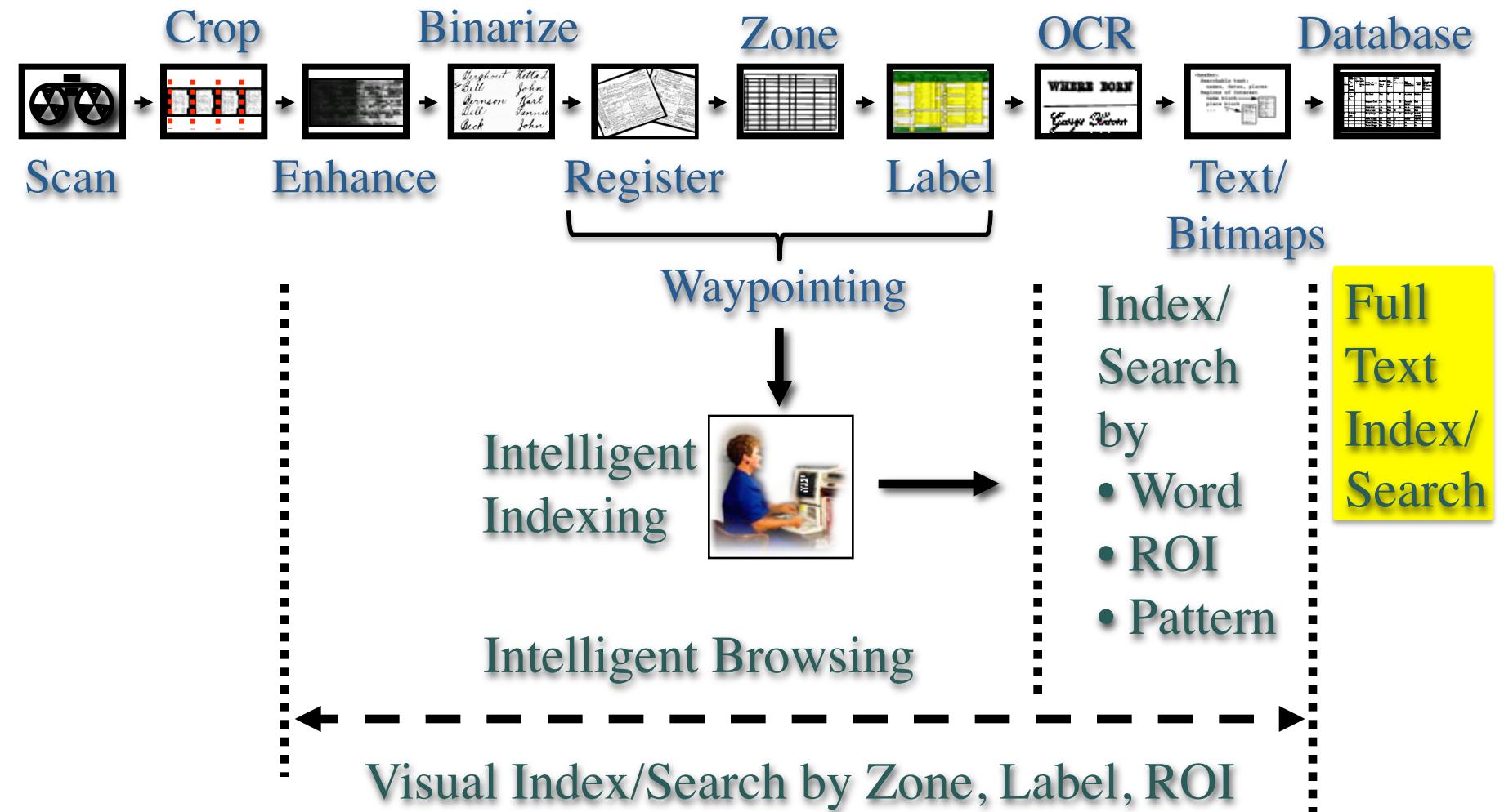
Regions of Interest:

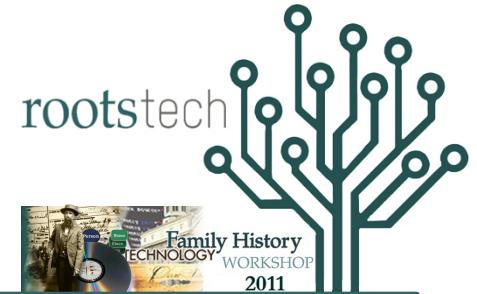


Partial Search:
Words, Bitmaps,
Regions of Interests
Logical Groupings



The Digital Microfilm Pipeline

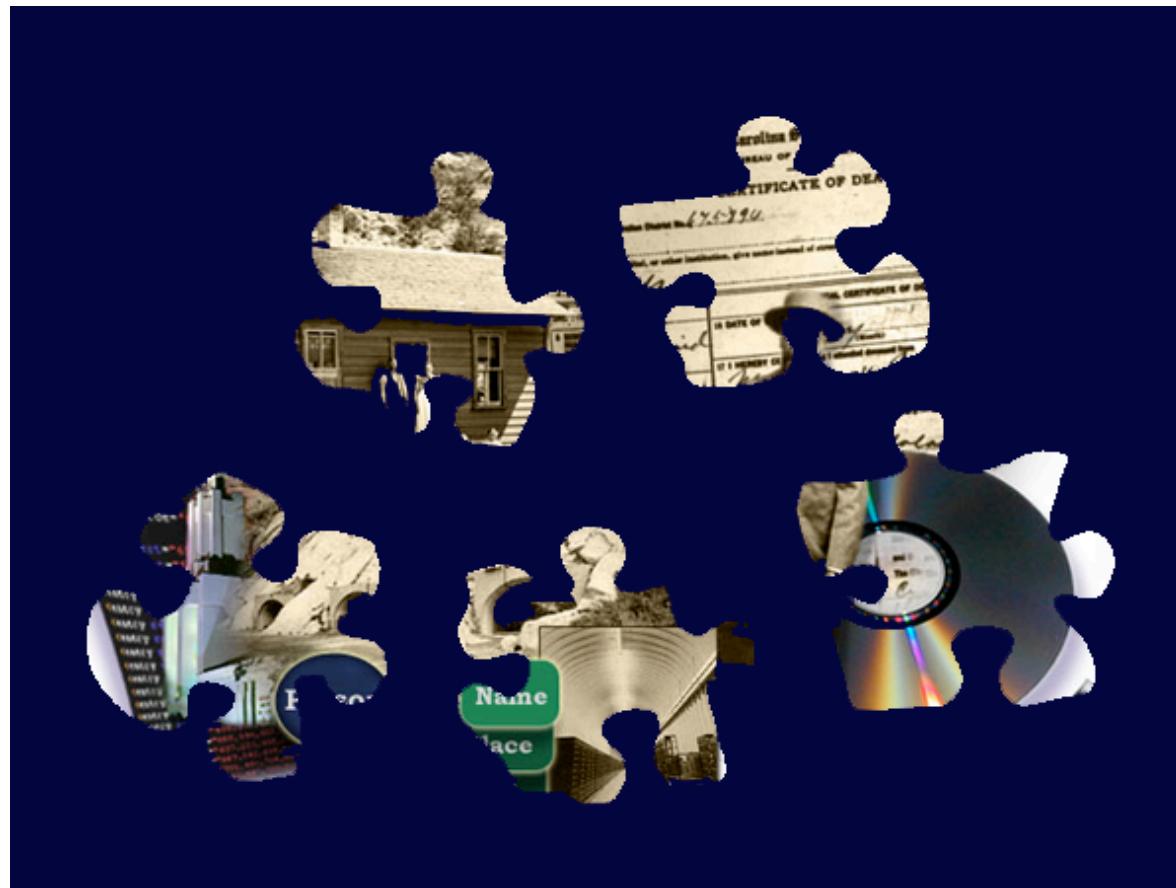




Full Text Database Search

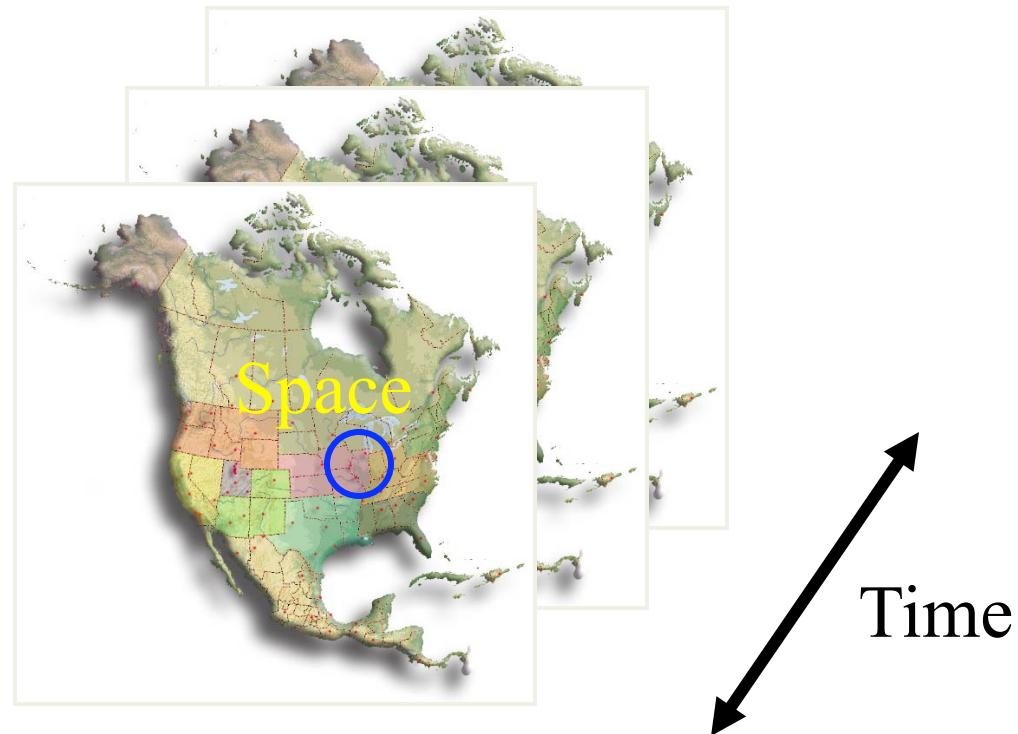
No. of Schedule	ROAD, STREET, &c., and No. or NAME of HOUSE	HOUSES In-habit- ed (U.) or Building (B.)	NAME and Surname of each Person	RELATION to Head of Family	CON-DITION as to Marriage	AGE last Birthday of Males Females	Rank, Profession, or OCCUPATION	WHERE BORN	If (1) Deaf-and-Dumb (2) Blind (3) Imbecile or Idiot (4) Lunatic
28	15 Church St.	1	Ann Grant	Head	W		50	Anniutant	Salisbury
			Margaret Grant	Dau	Unm		22	Domestic Servant	Kent
			Annie Grant	Dau	Unm		18	do. do.	Salisbury
			Austin Grant	Son	Unm	20		Hawker	Kent
29	72 Salt Lane	1	Emily Morgan	Head	W		34	Shopkeeper	Norfolk, Norwich
			Alfred Morgan	Son	Umn	12		Scholar	Andover
			Hubert Morgan	Son	Umn	9		do.	do.
			Walter Morgan	Son	Umn	7		do.	do.
			Emily Morgan	Dau	Umn		4	do.	do.

What are the other Pieces of the Puzzle?



Future Directions

- Longitudinal Search and Visualization
<proximity- space - # names - time>



Future Development: What is Needed (Dallan Quass)



- A comprehensive catalog of genealogical source information
 - when people "get stuck" - consult the catalog to find sources
- Collaboration models that allow people to maintain their private version of the data independently – like the google wave protocol or distributed version control systems
- “Push” systems for doing genealogy: The system prompts me by posting items on my “wall” telling me interesting things I could be doing to learn more about my genealogy

Future Development: What is Needed (Heath Nielson)



- A Common Genealogical Data Model: so that developers, providers and users can structure and link data unambiguously – "stitching" trees together. (Similar problem with Medical Data Records)
- Bi-directional linking of Conclusion Data \longleftrightarrow Source Data: Access to, and sharing of conclusive and source data suggests a need to bridge the gap between the two sources of data – invites more careful interpretation Increasing access ***and*** accessibility to source records. Need more compelling and efficient interfaces and algorithms to navigate, search and find data of interest.
- 12-bit (HDR) microfilm scanning to reduce sensitivity of film scanning to changes in film density and to maximize the dynamic range of the (8-bit) output

Future Development: What is Needed (Kirk Duffin)



- Closer coupling and improvement in human-assisted computing.
Why? Because data acquisition will far outstrip available human resources,
Human resources will outstrip needed expert genealogical knowledge
- Intelligent research assistants (computers)
 - highly specialized to answer specific questions or expedite menial tasks.
- Handwriting recognition system: human transcriber transparently trains computer:
 - makes connections between strokes and output text
 - exploits name authority and locality
 - becomes expert on this recorder's handwriting and the specialized domain
 - eventually system makes suggestions; human becomes arbiter
- Geographic Assistants with specific knowledge about a geographic area over time:
Could explain to a relatively new researcher how the place in question no longer exists by that name and is now known by a different name -- and by the way, it also exists in a different county now, because of boundary changes that took place in 18xx.

Future Development: What is Needed (Kirk Duffin)



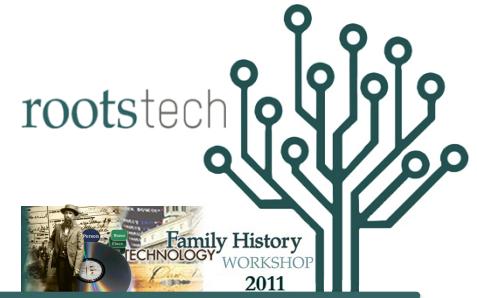
- Geographic Assistants with specific knowledge about a geographic area over time:
Could explain to a relatively new researcher how the place in question no longer exists by that name and is now known by a different name -- and by the way, it also exists in a different county now, because of boundary changes that took place in 18xx.
- Defining standards and protocols so that knowledge can be shared between artificial assistants.
- Improvements multi-lingual knowledge and transliteration so that researchers in one country are not required to become experts in the language and culture of their ancestors before doing effective research

Future Development: What is Needed (Kirk Duffin)



- Dynamic user interfaces and displays for multi-resolution, multi-layered views of a person's digital assets (photos, journals, documents, videos, sound recordings, etc.)
- Expand focus from individuals to families: Family history is typically an individual endeavor. But families are tracked through history, often as a set of individuals.
- Intelligent Data Mining: Analyze entire cross-sectional collections of data and collect them longitudinally. How does the 1830 census of an entire town connect with the 1840 census of the same town? And with subsequent censuses? Can family connections be automatically generated across these data sets? Then start connecting census info with that of neighboring locations. Can we automatically identify who moved? Who got married? Discover where they came from? Can this facilitate automatic creation of verifiable reference info for individuals, families? Can similar information also be gleaned from a comprehensive analysis of parish records?
- This will be of increasing importance for Church family history work because there is going to be a need to identify and do the work for those who have no descendants. These can only be found by expanding the research work from individuals to groups.

Future Development: What is Needed



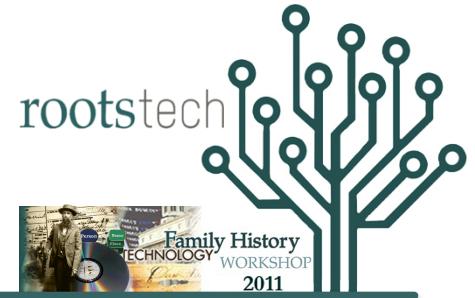
- Interchange format standards – a worthy GEDCOM successor
- Cloud/synch – same content available everywhere from my PC, to TV, tablet, smart phone, game console, car, etc...
- Better entity extraction – to create relationships between data mined from records
- Better search – interactive “hinting” search (i.e., Google instant), name-place-date-event entity extraction, etc.
- Links\connections\hints from tree framework (vitals, census, etc.) to rich media (stories, newspapers, yearbooks, photos, movies, videos, local histories, etc. adding meaning and detail beyond dates and names)

Future Development: What is Needed (Alan Eaton)

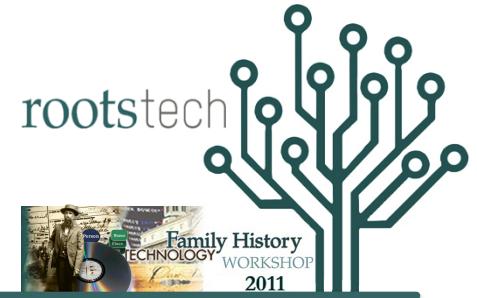


- Synchronization of the cloud(s)
- Sourcing
- Ease of consumption of genealogy services and data
- Everything fully indexed and/or structured

Future Development: What is Needed (Bill Harten)

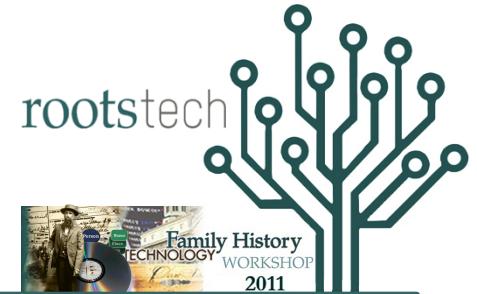


- **Challenge: Evidence-based Genealogical Computing.**
- **Evidence-centric data model and computerized evidence-linking:** Need to be able to verify, change, extend conclusions. Cannot build on other's conclusions alone – must follow source references. Need to see an image of the evidence.
- GEDCOM's syntax and extensibility was conceived for this evidence-oriented purpose, but its first and only application has been to represent only our linked conclusions, because the community demanded computerized pedigrees first. Work on linked conclusions without linked evidence will need to be done over.
- This has been understood by many since the early 90s, yet nothing substantive has happened to address it.



Back to the *FUTURE*

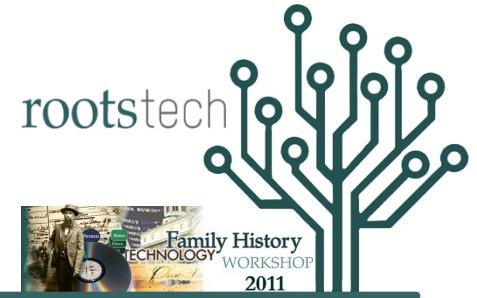
If hindsight is 20-20, what about foresight?



Back to the *FUTURE*

If hindsight is 20-20, what about foresight?





Back to the *FUTURE*

If hindsight is 20-20, what about foresight?



What kind of Family History Technologies might be with us in the year **2020**?

Back to the ***FUTURE***



Smartphones/Cameras/Recorders with

- “flex-cell” HHD display, contact scan, OCR
- HHD photo, full motion video, sound
- *IntelliSpeech* indexing, search and retrieval
- Virtual presence with multiple callers, collaborators
- Virtual networking with devices and friends
- Smart authentication and dynamic portal connect
- 1-10 terabytes of memory



Back to the ***FUTURE***

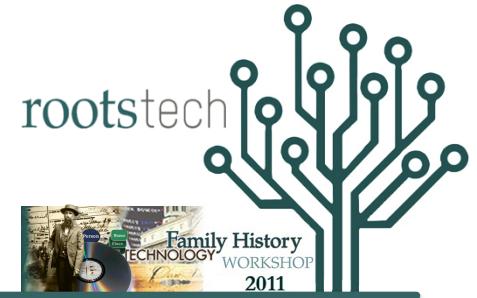


Personal “Wall” for digital assets



explore, view, query, organize
photos, movies, music, recordings,
digital documents, files, etc.

- Speech and gesture interaction and control
- Shared views, virtual presence with social network
- Virtual travel and presence to any destination
- Smart authentication, device and network connect
- 1-2 petabytes of memory



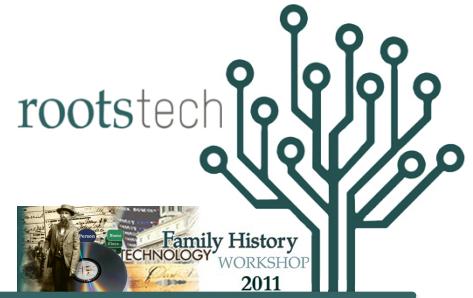
Back to the *FUTURE*

Intelligent Genealogical Research Assistant

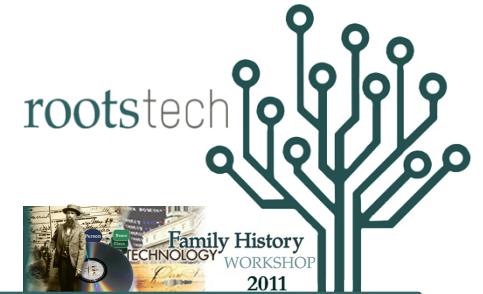
- Organizes and keeps track of photos, movies, digital documents, files, sources, what you were working on, names, dates, etc.
- Fully speech aware and interactive
- Domain, geographical, linguistic expertise
- Suggests what to work on next, asks good questions
- Accepts assignments, searches and mines data while you sleep; presents findings in the morning



How to move *FORWARD?*

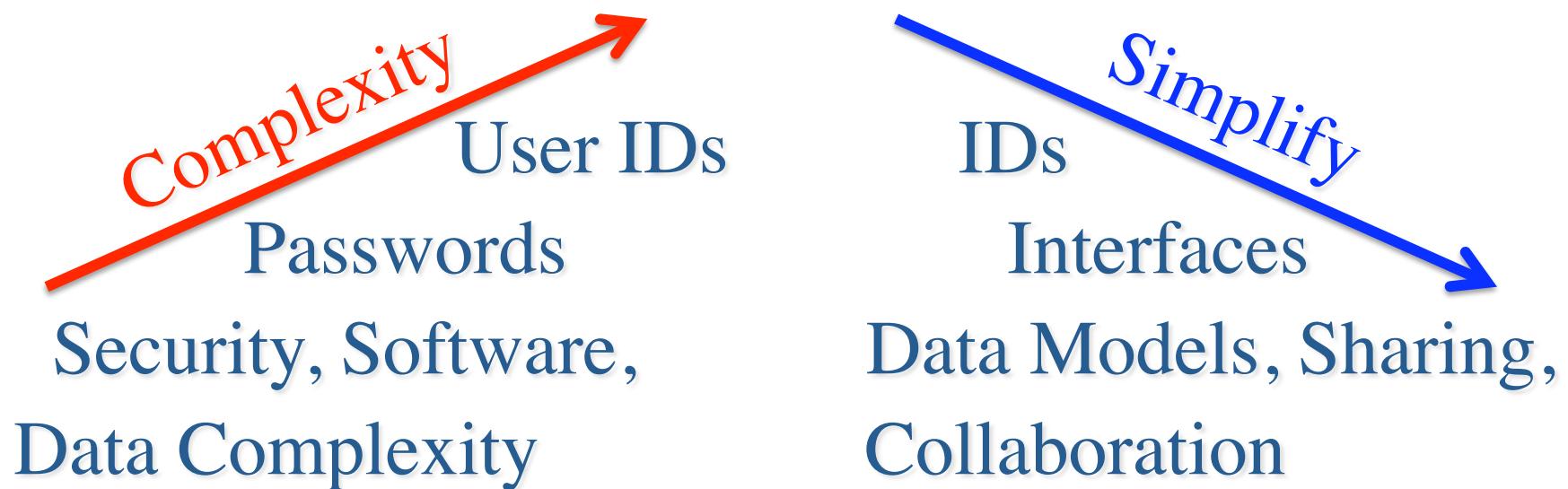


How to move ***FORWARD?***



Competition!

The Need to Simplify



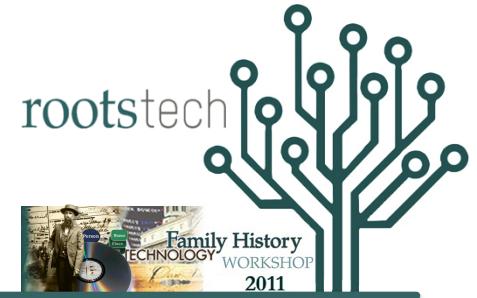
There is a great need to simplify and unify technologies, algorithms and data



Fun + Experience + Reward

- The busy mother of 3
- A turning-the-heart experience
- Rewarding: don't go away empty-handed
- Pac-Man genealogist
- The “20-minute genealogist”

Curt Witcher genealogy – get a life



The Need to Unify

- Common Data Model
- Record Linkage and Merging
- Standardized collaboration model
- Closer Human + Computer coupling
- Genealogy and Source Data

Of all of these, perhaps the most unifying concept of all is that this is the Lord's work to link and unite families in His temples.