

25 Years of Research in Family History Technologies at BYU: Where we have been Where we are going

Bill Barrett

Brigham Young University

The Microfilm Problem





- Early '90's
- Brittle Technology
- Poor Resolution

Granite Mountain Vault

Scanning the Granite Vault

2.5 Million rolls of microfilm

~ 1300 images per roll



Up to 25 Megabytes per image

1300 x 25,000,000 x 2,500,000

= 81.25 Petabytes















We envisioned a sequence of processing steps that needed to happen – like the Henry Ford Assembly line











Cropping - 1994





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				-	Emma Do.	Wife	Mar.		36		Do.; Longtown	
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						End of	St. M	Inel	Cool	sinstical District		
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	RG 11/2072.	COPYRIGHT PHOTOGRAPH - NOT TO BE REPRODUCED PHOTOGRAPHICALLY WITH- OUT PERNISSION OF THE PUBLIC RECORD OFFICE, LONDON	

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



1920 Utah Census Example



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Histogram Enhancement



(Left) Original scanned record (Right) After Enhancement



Threshold Enhancement

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(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

Family History Technology Workshop (<u>fhtw.byu.edu</u>) -2001



27 February 2018, Hinckley Alumni Center at BYU

The Future of Family History

Research talks, developer presentations and lightning talks. Handwriting recognition, automated record transcription, data modeling, machine learning, natural language processing, visualization, human interaction, user experience. Any technology that makes family history better.





About the Workshop

The Family History Technology Workshop has been held for 17 years, at both BYU and at RootsTech in Salt Lake City. Attendees include researchers, software developers, and professionals, brought together by their shared passion for improving family history technology.

Family History Technology Workshop (<u>fhtw.byu.edu</u>) - 2001



BY

BRIGHAM YOUNG UNIVERSITY

Family History Technology Lab (fhtl.byu.edu) - 2001









BYU

Binarization



(a) Original Image

John Caly 141 Junas Bowles

fidavil of

(b) Binarized Result

Median Filter Subtraction for background elimination



Binarization



Recursive Otsu Intensity Parsing and Accumulation







Registration



Not registered



Registered

Documents must be aligned, rotated and scaled to register them





Fourier-Mellin Transform for detection of rotation and shear





Fourier-Mellin Log Correlation, Scale Correction





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



URieggisteereld Miechan



445 Images





Segmentation & Zoning - Nielson 2003



Page	2]			The u	dermentioned l	Houses are	e situat	te within	i the Bounda	aries of the			
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No. of	BOAD, STREET, &c., and No. or NAME of HOUSE	H0 In- habit	USES Unin- habited (U.), or Building (B.)	NAME and Surname of each Person	RELATION to Head of Family	CON- DITION as to Marriage	AGE Birth Of	last iday f	Rank, Profe	ession, or OCCUPATION	WHERE BORN		lí 1) Deaf-and-Dun 9) Blind 8) Imbecile or Idi 4) Lunatic
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Candidate Line Identification - Nielson 2003



Pag	e 2]			The und	lermentioned l	Houses ar	e situ	ate with	nin the Boundaries of the			
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No. of	BOAD, STREET, &c. and No. or NAME of HO	ÜSE .	HOUSES In- habited habit- ed Building	NAME and Surname of each Person	BELATION to Head of Family	CON- DITION as to Marriage	AG: Bir	E last thday of	Rank, Profession, or OCCUPATION	WHERE BORN	(1) Deaf-and-Dum (2) Blind (3) Imbecile or Idio (4) Lumatio	
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Local "Snapping"

- Adjust the position of the mesh line to the digitized line
- For each line segment in the mesh, compute its filtered profile
- Calculate line strength $s(x) = e^{\frac{-(p_g - x)^2}{2s^2}} lp_f(x)$
- "Snap" to the location maximizing s(x)









Zoning

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Line detection and local refinement for document zoning



Zoning by Consensus



Consensus from 28 frames



Zoning by Consensus



Final Zone Template

Free-form Line Detection



- Kennard, 2006

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Recursive Graph Cut Line Segmentation


The Digital Microfilm Pipeline





Label Machine Print





Label Handwriting





Labeled Image

Civil Pa	rish [or Township] of <i>It. Mary.</i>	-City cipal I Show	or- Borongh bury.	n of Municipal Ward of Wolsh.	Parliamentary I Shieuse	Borough of	-Town-	or Vill	age or Hamlet- Urban Sanitary District of Shewsbury.	Bural-Sanitary District Eccle	sinstical Parish District of <i>It. Michael.</i>
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4	7, Charlotte St.	1		Michael Morrison	Head	Mar.	31		Liconsed Victualler	Middlesex; Islington	1
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				Elizabeth Morrison	Mother	W.		58	Annaitant	Salop; Shrewsbury	Lun
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		1.		Emma Do.	Wife	Mas.		36		Do.; Longtown	· · ·
		-		William Do.	Yon		12		Scholar	Salep; Ludlow	
				Henrietta Do.	Daul.			9	Do.	Do.; Do.	Deaf-and
				George Bacon	Shopman	Unm.	19		Grocer's Shofiman	Middlesex; Shoreditch	•
				Jane Cock	Serv.	Unm.		22	General Serv.	Scotland	
6		-		James F. Phillips	Head	Mar.	41		Banker's Clerk	Yorkshire; Lecels	
		-	-	Harriet Do.	Wife	Mar.		20	· · · · · · · · · · · · · · · · · · ·	Do. Bradford	
		-		Sophia White	Perv.	Unm.		16	General Serv.	Salop; Bridgenorth	
	9, Do.		196	`			1—				
7	1, Bird Lane	1		William Frampton	Head	Mas.	72		Coach Trimmet	Stuffordsh.; Bilston	
				Anno Do.	Wife	Mar.	F-	69		Do.; Tamworth	
8	2, Bird Lane	1		Thomas Johnson	Head	Wids.	68		Pectired Grocer	Devon; Honiton	_
				Henry Johnson	Son	Unm.	39		 Organist	Salep; Shrewsbury	Bi
			1	Emma Do.	Nicce	Unm.	F	41	Corset Maker	Midullesea; St. Pancias	
		-1		Jane Farmet	Apprentice	Unm.		18	Corset Maker (St/printice)	Salop; Ludlow	
9				Walter Campbell	Lodyer	Unm.	23		Thip Carpontes (out of employ)	Durham; Sunderland	
	Do. ·		2 S	•							
					End of	St. M	huel	Cech	siastical District		
	Total of Houses.	. 4	1 U 2 B	Tota	l of Males and	Females	Ĵ.	13			
				PUBLIC RECORD OFFICE	Reference:-						



Zoned and Labeled Image

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The Digital Microfilm Pipeline





Machine-Printed OCR



Must *detect* Machine Print before recognizing it

Machine vs. Hand Print - Pinson 2005, 2011







PCA Classification

Machine Print

- 26 fonts
- 273K CCs
- 6000Templates

Hand Print

- 2100 writers
- ~600K CCs



Precision



Machine Print – 94% Hand Print – 89%

Many Errors from Touching characters:

quantitative method is Mean hod takes note that an original was interpolated using a magni However as an enhancement to areas of the image that have



Split Touching Characters



- Character space within local distance threshold of machine print representatives
- Projected handwriting from B / Projected unknown connected component classified as handwriting
- Projected machine print from A / Projected unknown connected component classified as machine print



Machine-Printed OCR – Barzee '96

- Posting Paper on the Web

- First-generation print
- Font-specific OCR
- Grayscale attributes
- Multiple character prototypes for kerned and touching characters
- Lexicon/contextual error correction
- User interaction to recognize problem words

99.8% compared to 99.94% (human)



Machine-Printed OCR – Barzee '96

- Posting Paper on the Web

- Paper in -> HTML out
- Own OCR
- Graphics detection
- Captions detection
- Automatically generated links
- 99.8% OCR
- 99.96% human proof reading





The Digital Microfilm Pipeline





Handwriting Recognition

<u>NOT</u> a solved problem

	The undermentioned Houses are situate within the Boundaries of the Page 1	
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Children to m	mourn the logs	

All current approaches must <u>segment</u> words/lines before recognition is attempted

Segmentation in tabular documents – Davis 2015







Segmentation in tabular documents













3D cut overview

- Take subsection
- Find slopes
- Project image to 3D using slopes
- Graph cut





Graph creation

- Pixels are assigned slope values in a fill manner.
 - Pixels can receive multiple assignments.
- 3D distance map computed.
- Source and sink connections based on severing points.







Peal Apart Strokes





So how well does this all work? BYU

Horizontal segmentation:

- 92.6% accuracy on our application dataset.
- 89.5% accuracy on lines of the ICDAR2013 Handwriting Segmentation Contest





So how well does this all work?

- Vertical segmentation (without 3D cut):
- 80.7% accuracy on our application dataset.





Handwriting Recognition

Handwriting Recognition by Word Warping - Doug Kennard - 2012



Word Warping





Handwriting Recognition

- using Word Warping

Single author *in vocabulary* – 91-92%

Single author *in vocabulary* and *out of vocabulary* – 69-72%

Multi-author *in vocabulary* – 66% Multi-author *in*+*out* of vocab – 56%



The Digital Microfilm Pipeline







- Expert Transcription:
- An die herrn gehaimen Rāth
- Our system:
- An die herrn gehaimen Rāth





- Expert Transcription:
- Abgefertigt. vnd gebeten
- Our system:
- Abgefertigt. vnd gebete





- Expert Transcription:
- werden, Ine Carära aūs
- Our system:
- werden, Ine Carara aūs





- Expert Transcription:
- seiner: bei sich habenden welsch
- Our system:
- seiner. bei sich habenden welsch



Handwriting Datasets

- German (15th-18th Century)
- · George Washington properly bompany
- Smith Journals retired practiced
- · IAM (Multi-Author) Life because Shall
- MNIST (Numbers) 「シロリノ

German



177 office malifar.

- 1470 1805
- Bleed Through
- Overlapping strokes
- 95% Character
 - Accuracy
- 80.3% Word Accuracy

George Washington



Single Writer

- 99.3% Character Accuracy
- 98.4% Word Accuracy

Word Examples



Smith Journals



Single Writer

- 98.3% Character Accuracy
- 97% Word Accuracy

Word Examples





IAM Handwriting Dataset

657 Writers97.2% CharacterAccuracy95.03% WordAccuracy





MNIST Handwritten Digits

500 Writers - 99.62% Character Accuracy




Handwriting Datasets





But what about

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Nº 141

Rome le 3 Mars 1834. ANPR. 1877.

Honore Monsieur

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bour concerror donc, you mom. Lasiasan' dai' anive pour la confirmer avec des dispositions fort embarraster et un air derinan ; il du figure anair à de dicharger d'une inorme responsabililé; aum Congei a Son Lour il a più la parole, il a dituti in in Lermon : "Je jone consultais gur men Justiments "hour be loom he do Gothard it la diference qu'il minile, center jon ' clouterais aucune proponition on dillon des tionnes; mais je dais dire que ma Consumer part faire mes aspirations, it jume hormets de dire que les divoirs anumos ais à ai de mes consileyurs m'imporenaicul de languer loute negociation and bui it decondure immidiation and Varne les compagnies qui dout prêtes à le charger de laus le capital qui nous manger et dans con ditions. In homezourations and now m'aispaint par, mater entroprise serait assurs depuis plunium mois

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Invested you down droves a propose, ou la leve in pion et los ple de lever lossession, comme que deve at a chier a the approved par le comt de trak it pour par l'assess de la platetale, a de that, e que aprilantement al a prais la lo mis de home part le l'assession at des housance, ou un alligation part le l'assession de la mean de l'anitiene de que pour de los ple de locuels, de even de l'anitiene de mar

The READ Dataset

- ICDAR 2017 Competition
 - Multiple languages
 - German
 - French
 - English
 - No word-level segmentations
 - 50 training images with line-level segmentations and transcriptions
 - 10,000 training images with only transcriptions
 - 100-200 year old open format letters



Handwriting Recognition:





Handwriting Recognition:





0 Errors German Handwriting Recognitio

Hafon aufanden Given Hoofedand! Jef Jolen mit Am alcandmounting form wanagacifan yani Endydan Zofgurfom Cin Junda granour lad, in dow Baffings Jurich in Jan Lag. In fain , fringer nafanno roan dia Condiago car Jun. Lindnown of Ranch und Squilan gr bring Ala orlenn on monorandada Lewing nay uns yalecialen, mice if night langan Jainman, Fon100 midyndeguredan 80

Automated Transcription

Hochgeachteter Herr Präsident!

Ich habe mit der Beantwortung Ihrer verehrlichen zwei letzten Zuschriften bis heute zugewartet, in der Hoffnung heute in der Lage zu sein, Etwas Näheres über die Anträge des Hrn. Bundesrath Schenk mittheilen zu können. Da aber der erwartete Brief noch ausgeblieben, will ich nicht länger säumen. Ihnen den gefälligst



French Handwriting Recognition 0.1% CER .77% WER



Gouvernment Stalin. In me dit d'aiteurs que leur le monde, ou balie sait que les Corps morane aucquels en s'est adresse' refusement de participar à la nouvelle subvention et que par suite de cels le Gouvernment Kalien compte mettre cette subvention à la charge des nouvelles Compagnia avec lesquelles it est dans ce moment en tractations concernant l'exploitation étre chemins de for/italiens.

Se seconde raisen que fait valois N. le Commandous Valsecchi est que la Suisse n'a pas jurge à présent conveyé son adhision au Prois verbal de Sucarre. M. Valsecchi est dans l'errer : le Conseil fotbal Suisse, en notifiant au Gencomment Italien l'adhision de l'Allenreque, s'est déclaré prôt, aussiloit que l'Italie aura fait convaître son adhision, à convegner une Conférence des Représentaires de l'Allenreque de l'Halie accrédités auprès de lui, pour transforma le Crocès-verbal sfinal de Incerne en un supplément à la Convention international de l'Electre Halie en résulte évidement que le Conseil fédéral donne son adhision au dit Precis-verbal, comme l'Allenrague l'a fait de son coté.

Automated Transcription

Gouvernement Italien. En me dit d'ailleurs que tout le monde, en Italie sait que les Corps moraux auxquels on s'est adressé refuseront de participer à la nouvelle subvention et que par suite de cela le Gouvernement Italien compte mettre cette subvention à la charge des nouvelles Compagnies avec lesquelles il est dans ce moment en tractations concernant l'exploitation des chemins de fer italiens.

La seconde raison que fait valoir M. le Commandeur Valsecchi est que la Suisse n'a pas jusqu'à présent envoyé son adhésion au Procèsverbal de Lucerne. M. Valsecchi est dans l'erreur: le Conseil fédéral Suisse, en notifiant au Gouvernement Italien l'adhésion de l'Allemagne, s'est déclaré prêt, aussitôt que l'Italie aura fait connaître son adhésion, à convoquer une Conférence des Représentants de l'Allemagne et de l'Italie accrédités auprès de lui, pour transformer le Procès-verbal final de Lucerne en un supplément à la Convention internationale du 15 Octobre 1869. Il en résulte évidemment que le Conseil fédéral donne son adhésion au dit Procès-verbal, comme l'Allemagne l'a fait de son côté. Il n'y a donc aucune raison pour que l'Italie tarde davantage



German Handwriting Recognition 5.8% CER 15.6% WER





Automated Transcription

auf mich einen beßern Eindruk als die frühern Combinationen, immerhin vorausgesetzt, daß die erstellten Arbeiten wirklich den Werth des geforderten Betrages haben. –

Genehmigen Sie bei diesem Anlaße den erneuerte Versicherung ausgezeichnetster Hochachtung v. Ihrem freundschaftlich ergebenen

Luzern d. 20 Juni 1866. J. Zingg.



German Handwriting Recognition 49.25% CER 71.93% WER



Automated Transcription

G. Bellinzona 12 Mai 69.

Lieber Freund! A. Stelle mit Rhein heutiges Telegramm zeigte Dir anbei diesem Anlass unser Stichdaß wir in das letzte Stadium unserer Aufgabe gelangt sind. Das zweite eben vollendete war langedauernd, wechselvoll & schwierig. Ich enthalte mich einer einläßsich nicht unterung desselben, so weit lichen Erörterungen in Bern willf. nicht schon durch meine Aufe. der unterblieben bin vollständig Mittheilungen zeigen zu beste ten gemacht sein sollte. Dann für klar ist den zweiten Stadium, ist daß unser allen zweiten Teßin wieder selbst der Sonnelles der & die Mehrheit der Sie sich von den die Erwarten einmüthigen Vorschlägen denselben angelangt ist & denbleiben. Erweiterungen & selben verschiedene einverleibt hat. Die

Abänderungen ein kann man die

% Word Error Rate (WER) befinden ~1000 Documents in den ahnen insbesondere 20 71.93%



Handwriting Recognition:

- "Data Augmentation for Recognition of Handwritten Words and Lines using a CNN-LSTM Network", ICDAR 2017
- Competitions: ICFHR 2016 and ICDAR 2017





The Digital Microfilm Pipeline







Intelligent Indexing

BYU

- Robert Clawson 2014

Intelligent Indexing Video



Intelligent Indexing

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	Genara	daughter			F	W	14	S				40	44	yes
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Leveraging the Label





Leveraging the Label





Leveraging the Label



The Digital Microfilm Pipeline





Search by Subwords/Patterns - Davis 2018

<header:</pre> Name fields MANE and Surrouse of each Person Place fields WHERE DOLL Date fields 165 left Birthday Secondar ٥ť **Regions of Interest:** Partial Word Search: 39 Subwords 2: Samutited 12 **Regions of Interests** Logical Groupings



N-Gram Word Spotting for

1-gram

n

an

2-gram

3-gram



N-Gram Word Spotting for Computer-Assisted Transcription







The Digital Microfilm Pipeline





Full Text Database Search

No. of Schedule	ROAD, STREET, &c., and No. or NAME of HOUSE	HOUS In- habit- ed	ES Unin- habited (U.). or Building (B.)	NAME and Sumame of each Person	RELATION to Head of Family	CON- DITION as to Marriage	AGE la Birthday of Males	st Y 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.	



Family History Technology Lab

Fhtl.byu.edu

Fan Chart



Elastic Paper

Elasticpaper.org

Fan Chart

BYU

Where are we going?

- Deploying handwriting recognition technology
 - FamilySearch
 - Joe Price
 - Mark Clement
 - Humanities, Library, Department of Religion
- Last Session this afternoon
- Sneak Peek

Form V. S. No. 11-59M-8-20-17	STATE OF OHIO BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Hunore	1 44000
Township of Mourally Registration Distric	t No. 626 File No. 11899
Village of Primary Registratio	n District No. 4934 Registered No. 26
² FULL NAME IF redrick	Menturi Menturi
DERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
SEX 4 COLOR OR RACE 5 SINGLE	16 DATE OF DEATH
made If hite wind with with the word)	(Month) (Day) (Year)
DATE OF BIRTH	17 I HEREBY CERTIFY, That I attended deceased
(Month) (Day) (Year)	from 747 20 , 1919 , to 7 , 1917 ,
If LESS than I day,hrs.	and that death occurred on the date stated above at 4 m
yrsds. ormin.?	The CAUSE OF DEATH* was as follows:
a) Trade, profession, or particular kind of work Retried Laborers	, Right Lobar Preumoura
(b) General nature of industry, business, or establishment in	
which employed (or employer)	4
(State of county) Chio	Contributory Valmelay head lesion
10 NAME OF FATHER Patrick Marting	(SECONDARY) (Duration), yrs., mos., ds,
11 BIRTHPLACE OF FATHER (State or country)	(Signed) 4 1019 (Address) Norwelly Click
A 12 MAIDEN NAME OF MOTHER A	*State the DISEASE AUGING DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS of INJURY; and (2) whether ACCIDENTAL, SUICIDAL, or
A 13 BIRTHPLACE OF MOTHER (State country) - Alarrad	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients, or Recent Residents)
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsmosds. Stateyrsmosds.
(Informant) Sarah Martin	If not at place of death? Former or usual residence
(Address) Norgally O	10 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
Riled 74 1019 Hoff Master	20 UNDERTAKER ADDRESS
Registrar 11-3184	Marrie mady Norwalk Q

1919 Ohio Death Record

ATT OF OTIO

TO N II FOR DOD IN



	BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Mourally Registration District	No. 626 File No. 11899
Village of Primary Registration	n District No. 4934 Registered No. 26
City of (No. 2 FULL NAME IF redrick	
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
BEX 4 COLOR OR RACE BINGLE Make White word with the word	16 DATE OF DEATH 7.6 24, 1919. (Month) (Day) (Year)
" Mary 12t, 1878 (Month) + (Day) (Year)	17 I HEREBY CERTIFY, That I attended deceased from 744 20, 1919, to 24, 1919, 1919,
TAGE If LESS than I day,hrs.	that I last saw hma alive on Iter , 1917., and that death occurred, on the date stated above, at A .m.
8 OCCUPATION (a) Trade, profession, or particular kind of work. Retries dabouts (b) General nature of industry, business, or establishment in which employed (or employer)	The CAUSE OF DEATH* was as follows:
^o BIRTHPLACE (State or country) ¹⁰ NAME OF EATHER OF	(Duration) yrs, mos. 4 ds. Contributory Valmulan plant lesson
S TI BIRTHPLACE OF FATHER (State or country) & reland	(Signed) J H Mayrol M. C. File 2 4, 1919 (Address) Norwelly Hay
A 12 MAIDEN NAME OF MOTHER Frances yestor	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS or INJURY; and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.
13 BIRTHPLACE OF MOTHER (State or country)	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients, or Recent Residents) At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE (Informant) Aarah Martin	or deathyrsmosds. Stateyrsds. Where was disease contracted, If not at place of death? Former or usual residence
(Address) Norgally O	10 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
Filed 74 1919 Hot Masteria	Raible & Brady Norwelf (
11-3184	

1919 Ohio Death Record



- handwriting

Form V. S. No. 11-50M-8-20-17	BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Hurrow	
Township of Normalle Projection District	No 616 File No 11899
or	Had. (51
Village of Primary Registration	District No. 7.9. 4 Registered No. 76
City of	St.,Ward) a hospital or institu- instead of street and
2 FULL NAME U.F redrich	Mastin
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE 5 SINGLE MARRIED	16 DATE OF DEATH
- male If fute (Write the word)	(Month) (Oay) (Year)
GDATE OF BIRTH	¹⁷ I HEREBY CERTIFY, That I attended deceased
(Marth) + (Day) (Vart)	from 74 20, 1915, to 24, 1918,
7 AGE (Honth) (Day) (Teal)	that I last saw have alive on Tele 23, 1919,
71 9 22 1 dayhrs.	and that death occurred, on the date stated above, at 1.A.m.
yrs. mos. ds. or. min.?	The CAUSE of DEATH' was as follows:
(a) Trade, profession, or narticular kind of work Betweed Laborers	, Right Lobar Theumoura
(b) General nature of industry,	
which employed (or employer)	
(State or country)	(Dyration) yrs. mos. ds.
LIO NAME OF	Contributory Valmedan plat lesson
FATHER Patrick Martin	(SECONDART) (Duration) vrs. mos. ds.
2 11 BIRTHPLACE OF FATHER	(Signed) I T Mayne M.p.
(State or country) & reland	716 24, 1919 (Address) Morris alt Olig
Q 12 MAIDEN NAME OF MOTHER	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, or
A IS BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country)	or Recent Residents) At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsds. Stateyrsds. Where was disease contracted,
(Informant) Jarah Martin	If not at place of death?
- marth In	19 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
(Address)	It Maryblen 2-25 1019
Riled Vit 1019 Host Mantai	20 UNDERTAKER ADDRESS
Registrar	naw prady Norwald b
11-3184	/

1919 Ohio Death Record



- handwriting
- machine print

Form V. S. No. 11-50M-8-20-17	STATE OF OHIO PUPEAU OF VITAL STATISTICS
PLACE OF DEATH	CEPTIFICATE OF DEATH
Hardon	CERTIFICATE OF DEATH
County of Annual County	1:1 11800
Township of Mounally Registration Distric	t No. 676 File No.
Or Village of Primary Registratio	In District No 4934 Registered No 26
or	[If death occurred in a bestited or institu-
City of	St.,Ward) tion give its NAME instead of street and
² FULL NAME. Vf redrich	Mastin and
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE SINGLE	16 DATE OF DEATH
male that widowed any	746 - 24 , 1919
6 DATE OF BIRTH	(Month) (Day) (Year)
May 1st 1840	1 ¹⁷ I HEREBY CERTIFY, That I attended deceased
(Month) (Day) (Year)	from 747 20, 1919, to 27, 1919,
7 AGE If LESS that	that I last saw here alive on The <3 , 1919,
70 - 9 - 22 + 0 or min?	and that death occurred, on the date stated above, at
SOCCUPATION	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work Returned Laboration	1) Right Looar Theumonia
(b) General nature of industry,	
which employed (or employer)	
(State or country)	(Duration)
le hio	Contributory Uslow hand leseon
¹⁰ NAME OF FATHER D > ' /	(SRCONDARY)
IL BIRTHPLACE	Duration yrs mos ds.
GF FATHER (State or country)	All 24 1019 (Address) Morris alty Click
12 MAIDEN NAME	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES.
OF MOTHER It rances Nestan	state (1) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, OF HOMICIDAL.
13 BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country)	At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	Where was disease contracted, If not at place of death?
(Informant) Jarah Martin	Former or
man en la m	19 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
(Address)	- At Maryolen 2-25 mg
" 2/iii - Harry n. I'	20 UNDERTAKER ADDRESS
Filed 74 , 1914 Registrar	Raible & Brady Morivalto
11-3184	······································
H	

1919 Ohio Death Record

Many documents are heterogeneous consisting of

- handwriting
- machine print
- solid lines

Form V. S. No. 11-50M-8-20-17	STATE OF OHIO
	BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Junon	
The Monardle and Price	. 616 11899
or Registration District	No File No
Village of Primary Registration	District No. 49.94 Registered No. 26
OF City of	[If death occurred in a hospital or institu- tion class its NAME
	instead of street and number.]
² FULL NAME, VJ redrict	Jarun
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE SINGLE MARRIED UM	16 DATE OF DEATH 7.1 2/1 0
Male White OR Divorced and	746-7, 1917.
6 DATE OF BIRTH	(Monta) (Day) (Pear)
May 12 1848	Sam 74 20 1016 to 24 1019
(Month) (Day) (Year)	100m + 23 1917, to 73 1918,
If LESS than	that I last saw here alive on Area
70 yrs 9 mos 22 ds or min?	and that death occurred, on the date stated above, at <i>l</i>
SOCCUPATION	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work	1) Right Looor Theumoura
(b) General nature of industry,	
which employed (or employer)	
(State or country)	(Duration)
Chro	Contributory Value han hand leseon
¹⁰ NAME OF FATHER D > ' /	(SECONDARY)
II PIPTHPIACE Jamek Marling	(Duration) yrs mos ds,
G OF FATHER (State or country)	(Signed) Add in 9 (Adding) Margane ally Click
12 MAIDEN NAME	*State the DISPASS AUSING DEATH or in deaths from VIOLENT CAUSES
of MOTHER of sauces Nestan	state (1) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.
13 BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country)	At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsmosds. Stateyrsyrsmosds. Where was disease contracted,
Jarah Martin	If not at place of death? Former or
(informant).	usual residence
(Address) Organty Ch	At- Maryila 2-25
16 21. 16 11.20	20 UNDERTAKER ADDRESS
Filed 74 ,1919 Ocort Martin	Railes Brad DI - in aler
Registrar	man on fining contact
	/

1919 Ohio Death Record

Many documents are heterogeneous consisting of

- handwriting
- machine print
- solid lines
- dashed lines

Form V. S. No. 11-59M-8-20-17	STATE OF OHIO BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of funne	1., 11000
Township of Mourally Registration District No	626 File No.
Village of Primary Registration Distri	ct No. 49.3 4 Registered No. 26
City of	St.,Ward) instead of street and
2 FULL NAME, UF redrich Ma	rtice number.
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
B SEX 4 COLOR OR RACE SINGLE MARRIED 16 DAT	E OF DEATH
Male White CR Write the word)	(Month) (Day) (Year)
* DATE OF BIRTH May 12t 15+8.17	I HEREBY CERTIFY, That I attended deceased
(Month) (Day) (Year) from.	last saw has alive on 744 23 1019
TA 9 22 I day,	hast death occurred, on the date stated above, at 1.Am.
s OCCUPATION	AUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work	All Lover Theumoura
(b) General nature of industry, business, or establishment in which employed (or employer)	· · · · · · · · · · · · · · · · · · ·
BIRTHPLACE (State or country)	(Dyration) yrs. mos. 4 ds.
1º NAME OF EATHER Contr (Sac	butory Ualman hand lesson
11 BIRTHPLACE Patrick Martin	Duration yrs. mos. ds.
F OF FATHER (State or country) & reland 7.1	24, 1919 (Address) More ally Oling
A 12 MAIDEN NAME OF MOTHER A OF MOTHER	e the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES,) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, or DA
A 13 BIRTHPLACE OF MOTHER OF MOTHER	GTH OF RESIDENCE (For Hospitals, Institutions, Transients, cent Residents)
(State or country) At pl of dea	ace In the
(Informant) Jarah Martin If not	or
(Address) Norgally Q	CE OF BURIAL OR REMOVAL DATE OF BURIAL
16 2/	ERTAKER ADDRESS
Filed 74 , 1919 OtoH Master Registrar	ible & Brady Moringly 0
11-3184	

1919 Ohio Death Record



- handwriting
- machine print
- solid lines
- dashed lines
- stamps

E	STATE OF OHIO
Form V. S. No. 11-50M-8-20-17	BUREAU OF VITAL STATISTICS
PLACE OF DEATH	CEDTIFICATE OF DEATH
T MACH OF THAT II.	CERTIFICATE OF DEATH
County of Junon	1 14000
Mourelle	. 616
Township of The The Mary Registration District	No File No
Village of Primary Registration	District No. 4934 Registered No. 26
Or	[If death occurred in
City of	
If and if	Mapt'
² FULL NAME	Janu
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE SINGLE	16 DATE OF DEATH
nul 6 M X WIDOWED	716 24 1019
(Write the word)	(Month) (Day) (Year)
DATE OF BIRTH	I HEREBY CERTIFY. That I attended deceased
May 121 1878	from 711-20 1015 to 24 1019
(Month) (Day) (Year)	Home 2 2 2 3 3
7 AGE If LESS than	that I last saw have alive on Terr <, 1917,
7Λ 9 22 ar min 2	and that death occurred, on the date stated above, at
yrs. mos. ds. ds.	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or Roting of Change	Right Lobar Preumonia
particular kind of work	
(b) General nature of industry, business, or establishment in	
which employed (or employer)	
(State or country)	(Dyration)
le tuo	Contributory Helmilay head lesion
1º NAME OF FATHER	(SECONDARY)
Patrick Martin	(Duration) yrs. mos. ds.
11 BIRTHPLACE	(Signed) Thaytte , M.D.
Z (State or country) Ireland	FUG 24, 1919 (Address) More all Olig
12 MAIDEN NAME	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES,
a trances nestor	HOMICIDAL, SUICIDAL, OF INJURY, and (2) whether ACCIDENTAL, SUICIDAL, OF
13 BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country)	At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsds. Stateyrsds. Where was disease contracted.
Angle mantes	If not at place of death?
(Informant) Javan Wand	usual residence
(Adam) Mongalk B	19 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
15 VA	Maryo en 2-25 1919
2/21 - Marson 1	20 UNDERTAKER ADDRESS
Filed 1914 1914 Parties	Raiples Made Moringelo
11-3184 Registrar	y the providence of

1919 Ohio Death Record



- handwriting
- machine print
- solid lines
- dashed lines
- stamps
- that are
- interleaved

Form V. S. No. 11-50M-8-20-17	STATE OF OHIO
	BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Juron	
717. 01	616 11899
Township of Plo March Registration District	No File No
Or Village of Primary Registration	District No 4934 Registered No 26
or	[1f death occurred in
City of	
The second of a darah is	Mapter.]
FULL NAME	· fac fleed
DEDGONAL AND STATISTICAL DADTICULADS	MEDICAL CEDTIFICATE OF DEATH
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE SINGLE MARRIED MARRIED	16 DATE OF DEATH -1.1 211 0
Male What OR DIVORCED	746- 7, 1919.
6 DATE OF BIRTH	(Month) (Day) (Year)
May 12t .548	I HEREBY CERTIFY, That I attended deceased
(Month) (Day) $(Year)$	from 747 20, 1919, to 24, 1918,
7 AGE If LESS than	that I last saw have alive on Tele 23, 1919,
1 day,hrs.	and that death occurred on the date stated above at 1 m
70 yrs mos. 22 ds. ormin.?	
SOCCUPATION DE LA	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work	1) May 200ar (meumoura)
(b) General nature of industry,	
which employed (or employer)	
⁹ BIRTHPLACE (State or country)	(Duration) a wrad more 4 da
(Juip	a in Hale has he at taking
10 NAME OF	(SECONDARY)
FATHER Patrick Montain	(Duration),
11 BIRTHPLACE	(Signed) IT Mayrice M.D.
E OF FATHER (State or country)	71/2 24 1919 (Address) Morewelly Olics
12 MAIDEN NAME	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES,
V OF MOTHER (+ sauces Vesta	state (1) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, OF HOMICIDAL.
13 BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country)	or Recent Residents) At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsds. Stateyrsds.
A line to	If not at place of death?
(Informant) Jaran Marlier	usual residence
- malk 12	19 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
(Address)	Maryblen 2-25 1019
2/ 2/ 1 - Martin 1	20 UNDERTAKER ADDRESS
Piled / 2 st 1919 With Martan	Raible & Brade Mainebo
11-3184 Registrar	from from a to marked
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1919 Ohio Death Record



- handwriting
- machine print
- solid lines
- dashed lines
- stamps
- that are
- interleaved
- and frequently
- overlap

Form V. S. No. 11-50M-8-20-17	STATE OF OHIO
	BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Hurore	
Township of Mounally Registration District	No. 626 File No. 11899
or Deiner Beristertin	District No Ha 346 Desistand Nr. 26
or	[If death occurred in
City of	
ETHLI NAME If redrick	Martin number.]
FOLL NAME	
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
SEX 4 COLOR OR RACE SINGLE	16 DATE OF DEATH
whate I hite word	(Month) (Day) (Vear)
6 DATE OF BIRTH	17 I HEREBY CERTIFY That I attended deceased
May 121 1848	From 711-20 1015 to 24 1019
(Month) (Day) (Year)	that I had some fins a line of 746 23 1019
If LESS than I day	that I last saw new anve on Area
70 vrs. mos. 22 ds. or. min.?	and that death occurred, on the date stated above, at Z. R
BOCCUPATION DECLAR	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work	1) Many Lover Meumonia
(b) General nature of industry,	·····
which employ d (or employer)	
(State o country)	(Dyration)yrsmosds.
le hio	Contributory Halman hand lesson
FATHER D - ' I way for	(SECONDARY)
IL BIDTHDIACE	Duration yrs mos ds.
H OF FATHER (State of country)	(Signed)
A LIZ MAIDEN NAME	State the Distance Augusto Deamy or in deaths from Violenne Causes
OF MOTHER If and a hour of hour fan	state (1) MEANS OF INIURY: and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.
H IS BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country) Alarid	At place In the
THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsmosds. Stateyrsmosds. Where was disease contracted,
In Jarah Martin	If not at place of death? Former or
(Informant)	USUAL RESIDENCE
(Address) 2000 and 12	At-Intary! 2-3 C
15 2/ 4/6 1/2	20 UNDERTAKER ADDRESS
Filed 74 1919 Ocost Master	Railer Bred and in
Registrar Registrar	Martin grady Morwall &
113184	/

1919 Ohio Death Record



Form V. S. No. 11-50M-8-20-17	STATE OF OHIO
	BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
Harden	
County of Annual	1
Township of Mourally Registration District	No. 626 File No. 11899
or	Division Haget Division 26
Village of Primary Registration	a District No.
City of	St. Ward) tion events NAME
	instead of street and number.]
² FULL NAME J redrick	Martin
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE 1 SINGLE	16 DATE OF DEATH
Dia C M X WIDOWED Carrie	716 24 1019
Write the word)	(Month) (Day) (Year)
6 DATE OF BIRTH	17 I HERERY CERTIFY That I attended deceased
May 121 1848	Zed 20 24
(Month) (Day) (Year)	from 1917, to 1917, 1917,
7 AGE If LESS than	that I last saw have alive on Tele 23, 1919,
1 day,hrs.	and that death occurred on the date stated above at 1 4 m
70 yrs. 9 mos. 22 ds. or min.?	and that death occurred, on the date stated above, at
& OCCUPATION	The CAUSE of DEATH, was as follows:
(a) Trade, profession, or Retired Laborers.	1) Right Lovar Theumoura
(h) General antime of industry	
business, or establishment in	
BIRTHPLACE	
(State or country)	(Dyration) yrs, mos ds.
(hio	Contribution Halanday takant larence
10 NAME OF	(SECONDARY)
FATHER Patrick Mantain	(Duration) vrs. mos. ds.
11 BIRTHPLACE	(Simil) IF Mayne 1 46
H OF FATHER	21 9 4 . 9 him Mary all Alin
2 (State of country) & Mang	1. 191 (Address)
of Mother	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS OF INTURY; and (2) whether ACCIDENTAL SUICIDAL, or
a Trances perfor	HOMICIDAL.
13 BIRTHPLACE	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients,
(State or country)	At place In the
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	of deathyrsds. Stateyrsds.
1 Pin to	If not at place of death?
(Informant) Jarah Marluce	sormer or usual residence
- 1 el in	19 PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
(Address)	th- Mary: C. 2-25
15 3 / W	THE PARTAKER ADDRESS
124 a dort ma to	ADDRESS ADDRESS
Filed	and Drady Norwald 0
11-3184	the second secon
b and the second s	

1919 Ohio Death Record
The Problem

The interleave and overlap, greatly compounds the difficulty of OCR and handwriting recognition.

- Machine print and lines compete with handwriting

Form V. S. No. 11-50M-8-20-17	STATE OF OHIO BUDEAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Huran	
Township of Mourally Registration District	No. 616 File No. 11899
Village of Primary Registration	District No. 49344 Registered No. 26
City of	St.,Ward) a hospital or institu- tion, give its NAME instead of street and
² FULL NAME If redrick h	Martin
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
SEX COLOR OR RACE SINGLE MARRIED UMA	16 DATE OF DEATH 7.6 24, 1919
6 DATE OF BIRTH	(Month) (Day) (Year)
May 12 18+8	from 747-20, 1919, to 24, 1919,
7 AGE (Month) (Day) (Year)	that I last saw han alive on Tele 23, 1919,
70 - 9 - 22 i layhrs.	and that death occurred, on the date stated above, at 1.4.m.
s OCCUPATION	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work	nyny 2000 (neumoura)
(b) General nature of industry, business, or establishment in which employed (or employer)	
BIRTHPLACE (State or country)	(Duration) yrs. mos. 4 ds.
l'ho "	Contributory Halman hand lesion
PATHER Patrick Magatain	(SECONDARY) (Duration) vrs. mos. ds.
11 BIRTHPLACE OF FATHER (State country)	(Signed) 7 Mayrol M. M.
12 MAIDEN NAME OF MOTHER	*State the DISE SERVICE DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS OF INTURY, and (2) whether ACCIDENTAL, SUICIDAL, or
A 13 BIRTHPLACE OF MOTHER	 18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients, or Recent Residents)
(State or country)	At place In the State
Jarah Martin	where was usease contracted, If not at place of death? Former or
(Informant) Varance or a name	usual residence. 1º PLACE OF BURIAL OR REMOVAL DATE OF BURIAL
(Address)	It Maryo Cen 2-25 1019
Piled 74 , 1919 Host Mastein	20 UNDERTAKER ADDRESS
11-3184	y y y y willing

1919 Ohio Death Record

The Problem



- Machine print and lines compete with handwriting

- Machine print and handwriting are best recognized separately

Form V. S. No. 11-50M-8-20-17	STATE OF OHIO BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Hurore	1 44050
Township of Mounally Registration District	No. 626 File No. 11899
Village of Primary Registration	a District No. 4934 Registered No. 26
or City of (No.	[If death occurred in a hospital or institu- tion, give its NAME
FULL NAME IF redrick	Martin Instead of street and number.]
DEBRONAL AND STATISTICAL DADTICULADS	MEDICAL CERTIFICATE OF DEATH
B SEX 4 COLOR OR RACE SINGLE	16 DATE OF DEATH
mare A hit Widowed aris	74 24 , 1919
6 DATE OF BIRTH	I HEREBY CERTIFY. That I attended deceased
May 121 1848	from 74 20, 1919, to 24, 1918,
7 AGE (Month) (Day) (Year)	that I last saw han alive on Tele 23, 1919,
7Λ 9 22 1 day,hrs.	and that death occurred, on the date stated above, at 1. A.m.
s OCCUPATION	The CAUSE OF DEATH, was as follows:
(a) Trade, profession, or particular kind of work. Related dabores for	1) Right Looor Theumoura
(b) General nature of industry, business, or establishment in	·····
• BIRTHPLACE	
(State of country)	(Duration) yrs. mos. ds.
¹⁰ NAME OF FATHER D - ' P	(SECONDARY)
11 BIRTHPLACE	(Duration) yrs mos. ds.
GF FATHER (State or country) & reland	716 24 1919 (Inddress) Morusely Blig
A OF MOTHER of any en Mestan	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS OF INTURY: and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.
13 BIRTHPLACE OF MOTHER	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients, or Recent Residents)
(State or country)	At place In the of deathyrsmosds. Stateyrsmosds.
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE	Where was disease contracted, If not at place of death?
(Informant) Jaran Marine	usual residence.
(Address) Norgality	AT Mary 2-2 C
10 2/24 de Hout mant	20 UNDERTAKER ADDRESS
Filed Registrar	and prady Norwalk Q
11	/

1919 Ohio Death Record

The Pairing Problem



- 1-to-1
 1-to-many
 many-to-1
- Improved contextual recognition

O	
Form V. S. No. 11-50M-8-20-17	STATE OF OHIO BUREAU OF VITAL STATISTICS
PLACE OF DEATH.	CERTIFICATE OF DEATH
County of Huron	
Township of Mourally Registration Distric	t No. 626 File No. 11899
or Village of Primary Registratio	n District No. 49.34 Registered No. 26
or an	[If death occurred in a hospital or institu-
City of	
² FULL NAME VI redrict	Varun
PERSONAL AND STATISTICAL PARTICULARS	MEDICAL CERTIFICATE OF DEATH
3 SEX 4 COLOR OR RACE SINGLE	16 DATE OF DEATH
Male White or bivorded	(Month) (Day) (Year)
DATE OF BIRTH	¹⁷ I HEREBY CERTIFY, That I attended deceased
(Month) (Day) $(Year)$	from 74 20, 1919, to 24, 1919,
7 AGE If LESS than	that I last saw han alive on Tele 23, 1919,
70 9 22 1 day,hrs	and that death occurred, on the date stated above, at A.m.
s OCCUPATION	The CAUSE OF DEATH* was as follows:
(a) Trade, profession, or particular kind of work. Returned dabords in	1 right 200an Theirmonia
(b) General nature of industry, business, or establishment in	
• BIRTHPLACE	
(State or country)	(Duration) yrs. mos. ds.
1º NAME OF FATHER	(SECONDARY)
Patrick Martin	(Duration) yrs. mos. ds.
OF FATHER (State or country)	(Signed) A will water norman all Alexa
H 12 MAIDEN NAME	*State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES,
A OF MOTHER Frances yestor	state (1) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, OF HOMICIDAL.
13 BIRTHPLACE OF MOTHER	18 LENGTH OF RESIDENCE (For Hospitals, Institutions, Transients, or Recent Residents)
(State or country)	At place In the State
A THE ABOVE IS TRUE TO THE BEST OF MIT KNOWLEDGE	Where was disease contracted, If not at place of death?
(Informant) Javan Vyanut	usual residence
(Address) Norgaliz C	A Maryin 2-3 C
15 21 . He 11 22	20 UNDERTAKER ADDRESS
Filed / 24 , 1919 Wort Martan Registrar	Raible & Brady Morivalte
11-3184	
Ma calendaria de la calendaria	

1919 Ohio Death Record



What about different alphabets?

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Koseki

ARTS



- Asian Records Transcription System

Applications Places	tų En	4 0)) 3	:54 PM 🔱
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FamilySearch Prev Next

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The Digital Microfilm Pipeline



Credits: The Students

Kelly Lent – 1991 Xiaoxi Tan – 1991 Mai Zhuang – 1992 Timothy Heaton – 1993 Ralf Lehmann – 1995 Yoonkoo Cho – 1995 Kevin Christiansen – 1995 Alex Tang – 1996 Kai Wing Tam – 1998 Glen Sawyer – 1999 Kirk Duffin – 1999 Jack Reese – 1999 Eric Mortensen – 2000 Kevin Petersen – 2001 Alan Cheney -2001Luke Hutchison – 2003

Doug Kennard – 2003 Kenric White – 2003 Heath Nielson -2003Sam Pinson -2005Chris Nelson - 2006 Brian Price - 2006 Chris Armstrong - 2007 Seth Holladay - 2007 Oliver Nina - 2010 Cameron Christiansen - 2012 Doug Kennard - 2013 Robert Clawson - 2014 Kevin Bauer - 2016 Brian Davis - 2018 Seth Stewart - 2018 Curtis Wigington – 2018

Chris Tensmeyer Iain Lee Allen Liao Zhi-han Tsai





Intelligent Pen

Kevin's Slides



Intelligent Pen





Intelligent Pen





The Students







Ryan Cheatham Sophomore Loveland, Colorado

Robert Clawson MS Student San Diego, California

Doug Kennard PhD Student Austin, Texas



The Digital Microfilm Pipeline



Automated Waypointing: Extract content from titleboards*



Focus on key fields:

- Record type
- Place
- Date range
- Repository

Gehring

– Film number

FILMADO POR LA SOCIEDAD GENEALOGICA EN MEXICO	PARROQUIA DE SANTIAGO TEMAPACHE VER. DIOCESIS DE TUXPAM VER. MEX.
FOTOGRAFO REDUCCION (X).	TITULO DEL REGISTRO
FECHA DE FILMACION EXPOSICION JUN 15 1984 20	
NUMERO DE EMULSION NUMERO DE CAMARA 7456-452-1 51896	ITEM
NUMERO DEL PROYECTO NUMERO DEL ROLLO	

OCR/Index the text

* David Ouimette, Jake

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

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