GreenFIE: A Green Form-Based Information-Extraction System for Historical Documents

(Self-improving Extraction Systems)

Tae Woo Kim
David W. Embley
Stephen W. Liddle
A Green Information Extraction System

• “Green” systems improve with use

• GreenFIE
  – **Green Form-based Information Extraction**
  – Generates extraction rules by watching users work

• COMET
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**Register of Marriages and Baptisms.**

Jean, 6 Mar. 1698.
Cordoner, James, par., and Florence Landiss, par. of Paisley m. 13 June 1699.
Cordoner, John, par., and Jean Crawford, par. of Beith m. 16 June 1699.
Cordoner, John, and Isabella Speir, in Walkmilne of Johnstone m. 16 July 1673.

Jean, 17 May 1674.
James, 6 Oct. 1676.
Ages, 24 Jan. 1679.
Jonat, 24 June 1681.
John, 15 July 1685.

Cordoner, John, and Margaret Cochran, in Nether Walkmilne William 14 Mar. 1681.
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*Parish of Kilbarchan.*

Craig, James, and Mary Barr.
John, 30 May 1743.
Craig, James, and Elizabeth Story, 1751 in Law.
Elizabeth, 14 Aug. 1748.
Margaret, 3 Feb. 1751.
Robert, born 20 July 1753.

Craig, James, and Mary McDowall, in Monkland.
Janet, born 12 July 1751.
James, 8 April 1757.
Craig, John, par. of Beith, and Marione Speir.
Craig, John, and Janet Reid, in Forehouse.
Mary, 20 Oct. 1673.
Craig, John, and Isobel Merchant.
Craig, John, and Elizabeth Kirk, who came from Ireland.
Elizabeth, 12 Oct. 1690.
Craig, John, and Marion Clark, in Sweinlees, par. of Paisley.
Samuel, 14 June 1691.
Craig, John, par. of Neilston, in Cartside, and Margaret King.
Robert, 6 Dec. 1694.
Mary, 4 Dec. 1698.
Craig, John, and Margaret Robison.
Katherine, 18 Jan. 1741.
Craig, John, par. and Elizabeth Storie, in Abbey par. of Paisley.
Agnes, born 8 July 1730.
Craig, Thomas, in Kilbarchan, and Elizabeth M’Caslane.
Thomas, born 8 Jan. 1694.
Craig, William, and Agnes Duff.
William, in Kirktonne.

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**Parish of Kilbarchan.**

Craig, James, and Mary Barr
John, 30 May 1743.

Craig, James, and Elizabeth Story, 1751 in Law
Elizabeth, 14 Aug. 1748.
Margaret, 3 Feb. 1751.
Robert, born 26 July, 1753.
John, 25 Jan. 1753.

Craig, James, and Mary Mc'Dowall, in Monkland
Janet, born 12 July 1751.
James, 8 April 1757.

Craig, John, par. of Beith, and Marion Speir
Craig, John, and Janet Reid, in Forehouse
Mary, 20 Oct. 1673.

Craig, John, and Isobell Merchant
Craig, John, and Elizabeth Kirk, who came from Ireland
Elizabeth, 12 Oct. 1690.

Craig, John, and Marion Clark, in Swanlea, par. of Paisley
Samuel, 14 June 1691.

Craig, John, par. of Neilston, in Cartside, and Margaret King
Robert, 6 Dec. 1694.
Mary, 4 Dec. 1698.

Craig, John, and Margaret Robison
Katherine, 18 Jan. 1741.

Craig, John, par. and Elizabeth Storie, in Abbey par. of Paisley

Craig, Thomas, in Kilbarchan, and Elizabeth M'Caslane
Agnes, born 8 July 1750.

Craig, Thomas, in Kilbarchan, and Janet Crawford
Thomson, born 8 Feb. 1694.
Craig, James, and Mary Barr
John, 30 May 1743.
Craig, James, and Elizabeth Story, 1751 in Law
Elizabeth, 14 Aug. 1748.
Margaret, 3 Feb. 1751.
Robert, born 26 July 1732.
Craig, James, and Mary M'Dowall, in Monkland
Janet, born 12 July 1751.
James, 8 April 1757.
Craig, John, par. of Beith, and Marione Speir
Craig, John, and Janet Reid, in Forehouse
Mary, 20 Oct. 1673.
Craig, John, and Isobell Merchant
Craig, John, and Elizabeth Kirk, who came from Ireland
Elizabeth, 12 Oct. 1690.
Craig, John, and Marion Clark, in Sveinlees, par. of Paisley
Samuel, 14 June 1691.
Craig, John, par. of Neilston, in Cartside, and Margaret King
Robert, 6 Dec. 1694.
Mary, 4 Dec. 1698.
Craig, John, and Margaret Robison
Katherine, 18 Jan. 1741.
Craig, John, par., and Elizabeth Storie, in Abbey par. of Paisley
Craig, Thomas, in Kilbarchan, and Elizbeth M’Caslane
Agnes, born 8 July 1739.
Craig, Thomas, in Kilbarchan, and Janet Crawford
Thomas, born 8 Jan. 1764.
Craig, William, and Agnes Duff
Craig, William, in Kirktonne
William, 30 Sept. 1655.
Jean, 25 July 1658.
Craig, William, and Marion Broome, in Locherside
Marion, 14 May 1676.
Craig, William, and Margaret Dick, in Kirkton, 1692 in
Locherside, 1695 par. of Houstoun
William, 5 Feb. 1682.
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Craig, James, and Mary Barr
John, 30 May 1743.
Craig, James, and Elizabeth Story, 1751 in Law
Elizabeth, 14 Aug. 1748.
Margaret, 3 Feb. 1751.
Robert, born 29 July 1753
Craig, James, and Mary M'Dowall, in Monkland
Janet, born 12 July 1751.
James, 8 April 1757.
Craig, John, par. of Beith, and Marione Speir
Craig, John, and Janet Reid, in Forhouse
Mary, 20 Oct. 1673.
Craig, John, and Isobell Merchant
Craig, John, and Elizabeth Kirk, who came from Ireland
Elizabeth, 12 Oct. 1690.
Craig, John, and Marion Clark, in Sweinlees, pat. of Paisley
Samuel, 14 June 1691.
Craig, John, par. of Neilston, in Cartside, and Margaret King
Robert, 6 Dec. 1694.
Mary, 4 Dec. 1698.
Craig, John, and Margaret Robison
Katherine, 18 Jan. 1741.
Craig, John, par. and Elizabeth Storie, in Abbey par. of Paisley
p. 30 May 1747.
Craig, Thomas, in Kilbarchan, and Elizabeth M'Caslane
Agnes, born 8 July 1759.
Craig, Thomas, in Kilbarchan, and Janet Crawford
Thomas, born 8 Jan. 1764.
Craig, William, and Agnes Duff
Craig, William, in Kirktonne
William, 30 Sept. 1655.
Jean, 24 July 1638.
Craig, William, and Marion Broune, in Locherside
Margaret, 13 May 1666.
Register of Marriages and Baptisms. 31

Jean, 6 Mar. 1698.
Cordoner, James, par., and Florence Landiss, par. of Paisley
m. 13 June 1679
...
Elizabeth, 2 Sept. 1692.

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Regex Extraction Rules

Register of Marriages and Baptisms. 31
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Cordoner, James, par., and Florence Landiss, par. of Paisley
m. 13 June 1679
...
Elizabeth, 2 Sept. 1692.

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11
Register of Marriages and Baptisms. 31

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Cordoner, James, par., and Florence Landiss, par. of Paisley m. 13 June 1679
...
Elizabeth, 2 Sept. 1692.

- `\n([A-Z]{1}[a-z]{3}), \s(\d{1}\s[A-Z]{1}[a-z]{2}\s.\s\d{4})\.`
- `\n([A-Z]{1}[a-z]{1,5}), \s(\d{0,2}\s[A-Z]{1}[a-z]{1,3}\s.\s\d{2,6})\.`
- `\n([A-Z]{1}[a-z]{1,10}), \s(\d{1,2}\s[JFMASOND][a-z]{1,5}\s.\s\d{4})\.`
Margaret, 3 Feb. 1751.
Robert, born 29 July 1753.
Craig, James, and Mary M'Dowall, in Monkland p. 8 Dec. 1749
Janet, born 12 July 1751.

\n([A-Z]{1}[a-z]{3}), s(\d{1}s[A-Z]{1}[a-z]{2}\s\d{4})\.

\n([A-Z]{1}[a-z]{1,5}), s(\d{0,2}s[A-Z]{1}[a-z]{1,3}\s\d{2,6})\.

\n([A-Z]{1}[a-z]{1,10}), s(\d{1,2}s[JFMASOND][a-z]{1,5}\s\d{4})\.

\n([A-Z]{1}[a-z]{1,10}), s(\d{1,2}s[JFMASOND][a-z]{1,5}\s\d{4})\.
Margaret, 3 Feb. 1751.
Robert, born 29 July 1753.
Craig, James, and Mary M'Dowall, in Monkland p. 8 Dec. 1749
Janet, born 12 July 1751.

- \n([A-Z]{1}[a-z]{3}), \s(\d{1}\s[A-Z]{1}[a-z]{2}\./\s\d{4})\.
- \n([A-Z]{1}[a-z]{1,5}), \s(\d{0,2}\s[A-Z]{1}[a-z]{1,3}\./\s\d{2,6})\.
- \n([A-Z]{1}[a-z]{1,10}), \s(\d{1,2}\s[JFMASOND][a-z]{1,5}\./\s\d{4})\.
- \n([A-Z]{1}[a-z]{1,10}), \sb(\d{1,2}\s[JFMASOND][a-z]{1,5}\./\s\d{4})\. 
- \n([A-Z]{1}[a-z]{1,10}), \sborn\s(\d{1,2}\s[JFMASOND][a-z]{1,5}\./\s\d{4})\. 

...
Results: Naïve Generalization

Kilbarchan Person (Naïve Generalization): Precision & Recall by Number of Extraction Rules Generated

Pg. 31 (37 records)  Pg. 32 (+31 records)
Results: Type-Specific Generalization

Kilbarchan Person (Naive Generalization): Precision & Recall by Number of Extraction Rules Generated

Pg. 31 (37 records)  Pg. 32 (+31 records)

Type-Dependent

Pg. 31  Pg. 32
Results: Couple Form

Kilbarchan Couple: Precision & Recall by Number of Extraction Rules Generated

Pg. 31 (16 records)  Pg. 32 (+23 records)
Cordoner, James, par., and Florence Landiss, par. of Paisley m. 13 June 1679
Cordoner, John, and Catherine Adam m. 21 April 1656
Cordonner, John, par., and Jean Craufurd, par. of Beith m. Beith, 16 June 1659
Cordoner, John, and Issobell Speir, in Walkmilne of Johnstoun m. 16 July 1673
Cordoner, John, and Margaret Cochran, in Nether Walkmilne
Cordner, John, and Jonet Cochran, in Walkinshaw, 1688 in Walkmiln of Johnstoun m. 22 April 1680
Cordonar, William, and Jean Cochran m. 7 Feb. 1651
Cordoner, William, and Issobell Young, in Auchnames
Cordoner, William, and I liza Orr, in Netherwalkmilne of Johnstoun
Corss, John, and Jean Patison
Couper, James, and Issobell Load m. 30 Nov. 1682
Couper, James, par. of Erskine, and Mary Black, par. 30 Mar. 1744
Coupar, William, in Kilbarchan, and Janet Caldwell m. 29 Dec. 1768
Cowan, Daniel, in town par. of Paisley, and Margaret Dougal
Craig, James, par. of Kilbryde, and Jonet Cordonar, par. m. 28 June 1658
Craig, James, Moreland in Forehouse, and Jonet Reid m. Lochwinnoch, 18 Jan. 1693
Couple Patterns

Cordoner, James, par., and Florence Landiss, par. of Paisley m. 13 June 1679
Cordoner, John, and Catherine Adam m. 21 April 1656
Cordonnar, John, par., and Jean Craufurd, par. of Beith m. Beith, 16 June 1659
Cordoner, John, and Issobell Speir, in Walkmilne of Johnstoun m. 16 July 1673
Cordoner, John, and Margaret Cochran, in Nether Walkmilne
Cordner, John, and Jonet Cochran, in Walkinshaw, 1688 in Walkmiln of Johnstoun m. 22 April 1680
Cordonar, William, and jean Cochran m. 7 Feb. 1651
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Results: Couple Form

Precision: not necessarily 100% (over-generalization)

Kilbarchan Couple: Precision & Recall by Number of Extraction Rules Generated

Pg. 31 (16 records)  Pg. 32 (+23 records)
Conclusions

• GreenFIE is “green”!

• Extraction-rule generation
  – Document pattern consistency
  – Number and variability of patterns

• Go green!!