

Scientific Distance Report

User Manual v1.0.4

The screenshot shows the 'Scientific Distance Report' application window. It features several input fields and a 'Generate Reports' button. The 'Input Database #1' is set to 'Harvester Database' and 'Input Database #2' is set to 'Compare Database'. The 'Input file' is 'inputFile.csv', the 'Report file' is 'report.csv', and the 'MeSH Headings Report file' is 'MeSH report.csv'. There are three radio buttons for the rolling window: 'No rolling window' (selected), '3-year rolling window', and '5-year rolling window'. A checkbox 'Exclude common publications for pairs of scientists' is checked. The 'MeSH Stripping Options' dropdown is set to 'Stripped MeSH Terms (all terms)'. The 'Log file' path is 'C:\Users\andrew\Documents\Visual Studio 2010\Projects\ScientificDistance\' with an 'Open in Notepad' button. The 'Log' area shows a list of messages, with the last one '12/24/2011 11:18:49 AM - Finished report generation' highlighted. The status bar at the bottom shows 'v1.0.4' and 'Finished report generation'.

Scientific Distance Report

Input Database #1: Harvester Database

Input Database #2: Compare Database

Input file: inputFile.csv

Report file: report.csv

MeSH Headings Report file: MeSH report.csv

☒ No rolling window ☐ 3-year rolling window ☐ 5-year rolling window

☒ Exclude common publications for pairs of scientists

MeSH Stripping Options: Stripped MeSH Terms (all terms)

Log file: C:\Users\andrew\Documents\Visual Studio 2010\Projects\ScientificDistance\ Open in Notepad

Log:

- 12/24/2011 11:18:48 AM - Writing X0000003 (2002) - X0000004 (1992-1997)
- 12/24/2011 11:18:48 AM - Writing X0000005 () - X0000006 ()
- 12/24/2011 11:18:48 AM - Writing X0000001 () - X0000004 ()
- 12/24/2011 11:18:49 AM - Writing X0000003 (2002) - X0000004 (1992-1997)
- 12/24/2011 11:18:49 AM - Writing X0000002 (1999) - X0000003 (2001)
- 12/24/2011 11:18:49 AM - Writing X0000003 (2002) - Z1234567 ()
- 12/24/2011 11:18:49 AM - Finished report generation

v1.0.4 Finished report generation

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Table of Contents

1	Introduction	3
1.1	<i>Purpose</i>	3
1.2	<i>Scope</i>	3
1.3	<i>System Overview</i>	3
1.4	<i>References</i>	3
2	Installation	4
2.1	<i>Before you start...</i>	4
2.2	<i>Install the Scientific Distance Report software</i>	4
2.3	<i>Overview of the Scientific Distance Report software</i>	4
3	Using the Scientific Distance Report software	6
3.1	<i>Create the Input File</i>	6
3.2	<i>Generate the Report</i>	7
3.3	<i>Generating the report file</i>	7
3.4	<i>Fault tolerance</i>	8
3.5	<i>The report files</i>	10
3.5.1	<i>Overlap Report</i>	10
3.5.2	<i>MeSH Headings Report</i>	11
	<u>GNU Free Documentation License</u>	12
4	Revision History	15

1 Introduction

1.1 Purpose

The purpose of this document is to serve as a guide to people who want to use the Scientific Distance Report software. It should give them all of the information necessary to install, configure and use the software.

1.2 Scope

This document contains step-by-step instructions to show users how to install, configure and use the Scientific Distance Report software on a machine running Windows Vista, XP or Server. It covers:

- Installing the software
- Preparing the input file and databases
- Using software to generate an overlap report
- Options that that can be used for report generation

1.3 System Overview

The purpose of the Scientific Distance Report to generate a data that will be used to statistically test hypotheses about **scientific distance** between people whose publication data gathered using the Publication Harvester software. Scientific distance between two scientists is measured by finding the degree by which the academic topics studied by the two scientists overlap. The goal of the software is to generate the data necessary to measure this distance by analyzing the keywords attached to each scientist's publications, and computing the overlap between the sets of publications for pairs of scientists.

The publication and keyword data already exists in a database that was previously created by the Publication Harvester. For more information on the Publication Harvester, see the website:

<http://www.stellman-greene.com/PublicationHarvester>

1.4 References

The Scientific Distance Report software requires either one or two databases created using the Publication Harvester software. This manual does not explain the use of that software – the manual and specification of the Publication Harvester software can be found at <http://www.stellman-greene.com/PublicationHarvester/>

2 Installation

This section describes how to install the Scientific Distance Report software.

2.1 Before you start...

The Scientific Distance Report software is built to operate on a database that was created by the Publication Harvester. The software also requires .NET Framework 3.5, MySQL 5.0 and MySQL/ODBC 3.51 or 5.0. You can find installation instructions for installing all of these things in the manual for the Publication Harvester, which can be downloaded from the Publication Harvester website: <http://stellman-greene.com/PublicationHarvester/>

2.2 Install the Scientific Distance Report software

Download the latest version of the Scientific Distance Report software installer from the website (<http://stellman-greene.com/ScientificDistance/bin/latest/>), unzip it and run setup.exe to install the software. Once each installer is finished, it will run the software it installed. It will appear in the Start menu listed under “Publication Harvester”. In addition, there are sample files that can be downloaded from the Scientific Distance Report website:

- [inputFile.csv](#) -- sample input file that works with the Scientific Distance Report software
- [Harvester input.xls](#) -- an input file for the Publication Harvester to generate data that matches the sample input file

2.3 Overview of the Scientific Distance Report software

The purpose of the software is to generate data that can be used to calculate the scientific distance between pairs of scientists. It does this by examining the sets of keywords associated with each scientist’s publications, and determining which keywords overlap between the two sets. Once these sets of keywords are known, the proximity between the scientists can be computed.

The goal of the software is to gather the data needed to compute the scientific distance between pairs of scientists. The distance between two scientists is a measure of the degree to which their research overlaps. To measure this overlap, the MeSH heading keywords attached to the publications for each of the scientists in the pair are gathered. Once those keywords are known, three different measurements may be taken:

1. The number of keywords associated with scientist #1
2. The number of keywords associated with scientist #2
3. The number of keywords both scientists have in common, or the **overlap**

Once these numbers are known, the proximity from scientist #1 to scientist #2 can be calculated, as can the proximity from scientist #2 to scientist #1:

$$\text{Proximity from \#1 to \#2} = \frac{\text{\# keywords in the overlap}}{\text{\# keywords associated with scientist \#1}}$$

The distance ranges from 0 to 1, where 0 is no overlap and 1 is complete overlap. If scientist #1 is a coauthor on every paper published by scientist #2, then the number of keywords associated with scientist #1 will be the same as the overlap, so the distance will be 1. On the other hand, if scientist #1's publications have no keywords that appear on any publication from scientist #2, then they will have no keywords in common; the overlap will be zero, which means that the distance will be zero.

The scientific distance calculation is not symmetric. For example, assume scientist #1 published many papers over a long career, while scientist #2 only published a small number of papers and coauthored most of them with scientist #1. The number of keywords associated with scientist #1 will be very large – much larger than the overlap – so the proximity from scientist #1 to scientist #2 will be relatively low. On the other hand, the most of keywords associated with scientist #2 will appear in the overlap, so the two numbers will be very close. This will yield a proximity value that is relatively high.

There are actually two different ways to measure proximity, based on the way the keyword counts are generated. A scientist will typically publish several papers that have many keywords in common. It may be useful to weigh keyword counts based on the frequency of keyword occurrence: if a keyword appears in four publications, it should carry more weight than a keyword that appears in one publication. On the other hand, it may be useful in some analyses to consider only unique keywords, weighing each keyword equally no matter how many times it appears in publications. To allow for both of these analyses, the software generates two keyword counts: a “frequency” count that weighs more frequent keywords more heavily, and a “unique” count that weighs each keyword equally.

Additional details about how these counts are generated can be found in the software requirements specification (SRS) that was used to build the software. It can be downloaded from the website:

<http://www.stellman-greene.com/ScientificDistance/Scientific Distance SRS.doc>

3 Using the Scientific Distance Report software

Now that Scientific Distance Report software has been installed, it can be used to generate reports from either one or two Publication Harvester databases. Before you can do that, you'll need to use the Publication Harvester to create a database. Once you have that database, the Scientific Distance Report software will search through it, find keyword data about scientists in the input file that you provide, and create the reports.

3.1 Create the Input File

The purpose of the report is to identify the distance between pairs (or *dyads*) of scientists. A CSV-formatted input file (with a header row) is used to tell the program what dyads to include in the report. A dyad consists of two identifiers (or *setnbs*) to identify each of the two scientists to compare. It optionally contains a year (1984) or range of years (1983-1996) for each of the scientists. The input file contains one dyad per row. The software generates one row in the report for every row in the input file (unless it is using a rolling window, in which case it generates a set of rows per each row in the input file).

The input file is in the following format:

setnb1	The identifier for the first scientist
range1	The time window for the first scientist. This can either be blank, a single year, or a range of years.
setnb2	The identifier for the second scientist
range2	The time window for the second scientist. This can either be blank, a single year, or a range of years.

Note that the year specification for scientist #1 does not necessarily have to match the one for scientist #2. For example, it might make sense to compare the publications for scientist #1 in 1993 with the publications for scientist #2 in 1994-1998.

Also, the two scientist identifiers may be identical. It might make sense to compare the publications for a scientist from 1986-1995 to the publications for the same scientist for 1996-2004 (to see how the scientist's focus may have changed over a career).

A sample input file can be downloaded from the following URL:

<http://www.stellman-greene.com/ScientificDistance/inputFile.csv>

3.2 Generate the Report

Before you can generate a report for the pairs of scientists in the input file, you'll need to create and populate a database using the Publication Harvester. Once that database is created and populated, start the software. The report program will display an empty form:

The screenshot shows the 'Scientific Distance Report' application window. It features several input fields and options for generating a report. At the top, there are two dropdown menus for 'Input Database #1' and 'Input Database #2', each with a browse button (three dots) to its right. Below these are three text input fields: 'Input file', 'Report file', and 'MeSH Headings Report file', each with a corresponding browse button. To the right of these fields is a 'Generate Reports' button. Below the input fields are three radio buttons for windowing: 'No rolling window' (selected), '3-year rolling window', and '5-year rolling window'. There is also a checkbox for 'Exclude common publications for pairs of scientists'. Below this is a dropdown menu for 'MeSH Stripping Options' currently set to 'Stripped MeSH Terms (all terms)'. At the bottom, there is a 'Log file' text field containing the path 'C:\Users\andrew\Documents\Visual Studio 2010\Projects\ScientificDistance\' and an 'Open in Notepad' button. A large 'Log' text area is positioned below the log file path. The version 'v1.0.4' is displayed in the bottom left corner.

3.3 Generating the report file

To generate a report, fill in the following fields:

- Input Database #1: The Publication Harvester database where the publications for the scientists whose identifiers are specified by the `setnb1` field in the input file. When you click on the arrow on the right-hand side of the field, the software will list all of the ODBC data sources. Select the one that points to the database you want to use. If you click the “...” button next to the two Input Database fields, the software will launch the ODBC Data Source Administrator. (See the *Publication Harvester manual* for more information about ODBC data sources and using the

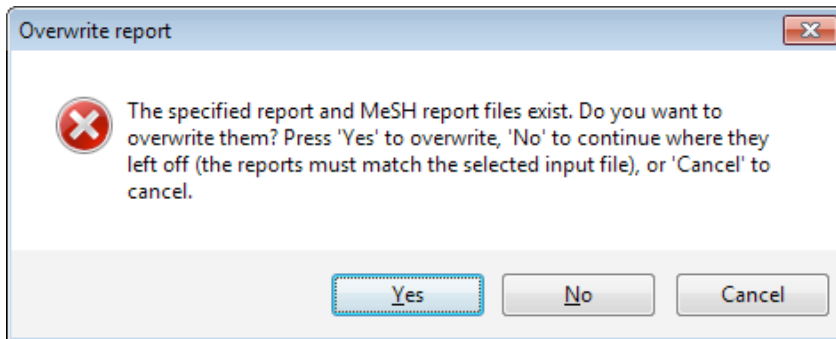
ODBC Data Source Administrator. The Publication Harvester manual can be downloaded from the website: <http://stellman-greene.com/PublicationHarvester/>)

- Input Database #2: The Publication Harvester database where the publications for the scientists whose identifiers are specified by the `setnb2` field in the input file.
 - **NOTE:** The Scientific Distance Report is built to pull its data from two databases. Each row in the input file specifies two scientists and their associated date ranges. Typically, you'll want to pull the data for scientist #1 from one database, and scientist #2 from another. However, sometimes you may want to pull all publication data for scientists from the same database. To do this, simply **specify the same ODBC data source** for both Input Database fields. When you do this, the software will retrieve all data from the same database.
- Input File: This is the filename of the input file you wish to use to generate the report (see the section on the input file above for more information about it). If you click the “...” button next to the Input File field, the software will pop up an “Open File” dialog box, which you can use to browse to the input file.
- Report file and MeSH Headings file: Use these fields to specify the names of the two output files. The “...” button next to each field brings up a “Save File” dialog box, which you can use to browse to the location to save the file. (See below for more details about the reports generated by the software.)
- Rolling Window radio buttons: You may optionally select a 3- or 5-year rolling window by clicking the “3-year rolling window” or “5-year rolling window” radio button. When you use a rolling window, the software generates multiple rows in the report file for every row in the input file, generating one output row per 3- or 5-year window range. For more information on how rolling windows are calculated, see the software requirements specification (SRS): <http://www.stellman-greene.com/ScientificDistance/Scientific Distance SRS.doc>
- Exclude common publications for pairs of scientists: Normally, when the overlap between two scientists in a pair is calculated, all publications are taken into account. When this box is checked, then any publication authored by both scientists is removed from both scientists' publication lists before the overlap is calculated.
- MeSH stripping options: The system supports four different methods for stripping MeSH headings. See the SRS for details on the different methods.
- Log: All activity performed by the program is written to a log file. The location of that log file is shown in the “Log file” box, and the contents of the log are displayed in the “Log” box. You may open up the log at any time by clicking the “Open in Notepad” button.

Once you've filled in everything on the form, click the “Generate Reports” button. The software will read input file, and then generate the two report files based on the information in the two input databases.

3.4 Fault tolerance

If the report files already exist, the software will display this window:



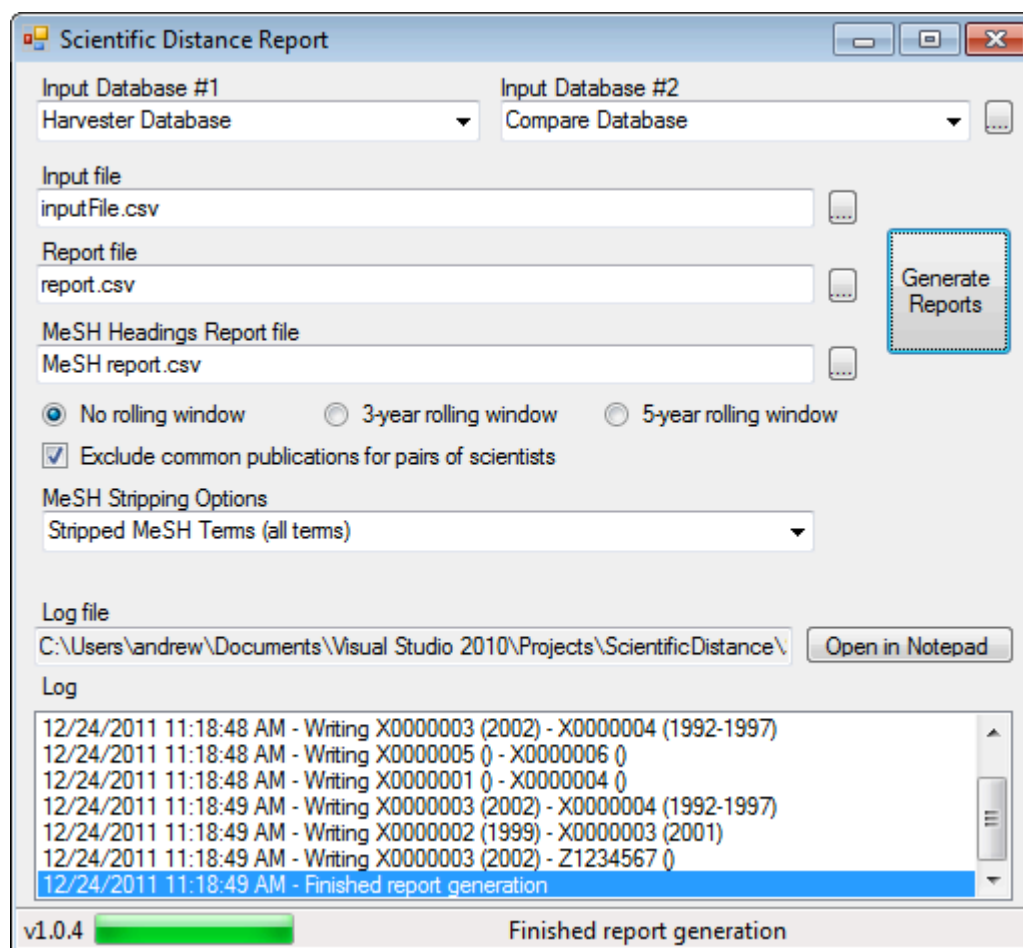
If you click the ‘Yes’ button, the program will delete the existing report files and generate them entirely.

If you click the ‘No’ button, then the program will read the existing report files and continue generating them from where it previously left off. This is a useful fault tolerance feature – if your previous run was interrupted (for example, if Windows crashed halfway through a long run), then you can use this to continue your previous run. The software will compare the report file against the MeSH headings report to make sure they match; if they don’t, it will not generate the reports. When the software continues the files, it will rename the existing report files by adding ‘.bak’ to the end of the filename, so you have a backup of the files.

You may also click the ‘Cancel’ button and change the names of the report files in order to avoid the ‘Overwrite report’ dialog box.

NOTE: If you specified 3-year or 5-year rolling window, then the software will not continue a previous report. It will only overwrite the previous report.

As the software generates the reports, it updates the log, as well as the status bar on the bottom of the form. If any errors or problems occur, they will be displayed in the log. Once the software is done generating the reports, it will display the message, “Finished report generation”:



3.5 The report files

The software generates two report files that contain the results of the analysis. The first file is the **overlap report**, which contains the information about the keyword overlap. This is the main result of the software, and contains the main data about scientific distance between the dyads of scientists. The second file is the **MeSH headings report**, which contains information about the specific MeSH headings for each scientist in the report.

For more details on how each of the output values are calculated, see the software requirements specification: <http://www.stellman-greene.com/ScientificDistance/Scientific Distance SRS.doc>

3.5.1 Overlap Report

The overlap report is a comma-delimited file that shows the keyword overlap between the two scientists in the dyad. It consists of the following columns:

setnb1	The identifier for the first scientist, copied from the input file
range1	The time window for the first scientist, copied from the input file
setnb2	The identifier for the second scientist, copied from the input file
range2	The time window for the second scientist, copied from the input file
nb_unq_keywords_1	The count of unique keywords for scientist #1. This is calculated by counting all of the unique keywords attached to publications for the first scientist with publication years within the date range.
nb_frq_keywords_1	The total count of keywords attached to scientist #1. This is

	calculating all of the keywords attached to publications for the first scientist with publication years within the date range. This differs from Nb_unq_keywords_1 in that it counts duplicate keywords. So if three publications have the keyword “Antibodies,” that keyword adds 3 to the count.
nb_unq_keywords_2	The count of unique keywords for scientist #2.
nb_frq_keywords_2	The total count of keywords for scientist #2.
nb_unq_keywords_ovrlp	The count of unique overlapping keywords. This is calculated by counting the unique keywords that appear in at least one publication for scientist #1 and at least one publication for scientist #2 (within the specified date ranges).
nb_frq_keywords_ovrlp	The total count of overlapping keywords. This is similar to Nb_unq_keywords_ovrlap, except that it counts duplicate keywords.

3.5.2 MeSH Headings Report

The MeSH headings report is a comma-delimited file that lists the keywords for each scientist in the file. All of the scientists are combined into one report file – scientists from both databases will be reported in a single MeSH headings report file.

setnb	The identifier for the scientist
range	The date range for the publication years
heading	The MeSH heading (with asterisk and trailing categories stripped off)
count	The number of times the MeSH heading occurs within publications for the scientist and date range

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4 Revision History

Date	Author	Description
10-Mar-2008	Andrew Stellman	Initial version
27-Dec-2011	Andrew Stellman	Added MeSH stripping options