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*SAS Contextual Analysis In-Database Scoring 14.2 for Hadoop: User’s Guide* **v**

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Audience

This book is for users who want to work with SAS Contextual Analysis scoring models in Hadoop. It is assumed that you know how to use SAS Contextual Analysis.

Requirements

You must have the following products licensed:

• SAS Contextual Analysis
• SAS In-Database Code Accelerator for Hadoop

Before you can use the In-Database Scoring for Hadoop, you must follow the steps in Chapters 2 and 3 of *SAS Contextual Analysis In-Database Scoring for Hadoop: Administrator’s Guide.*
Chapter 1
Introduction

About SAS Contextual Analysis In-Database Scoring for Hadoop

This product enables you to run scoring models generated in SAS Contextual Analysis inside a Hadoop environment. Sample code that you would run is provided here. Please see the appropriate sections of this book for your needs.

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Chapter 2

Using the Text Analytics Models

Accessing the Models

Text analytics models include score code, which is generated within SAS Contextual Analysis. To generate the score code, see the section “Viewing and Downloading Code” in Chapter 2 of *SAS Contextual Analysis: User’s Guide*.

- To locate the binary files for concepts and categories, see “Locating the Rules Files (LI and MCO)” in *SAS Contextual Analysis: Administrator’s Guide*.

- To locate language-specific SAM (binary) files that are used in SAS Contextual Analysis, see the file \tktg\sasmisc\nn-base.sam (Windows) or misc/ tktg/nn-base.sam (UNIX) under your SAS installation directory. Note that the first two characters (nn) of the .sam filename denote the licensed language. For example, in en-base.sam, the en denotes English.

- To locate sentiment (SAM) files that you created using SAS Sentiment Analysis Studio, see *SAS Sentiment Analysis Studio 12.2: User’s Guide*.

Using the Concept Model

The following code can be executed in SAS Contextual Analysis In-Database Scoring for Hadoop for concept extraction.

```/*
 * Concept score code for Hadoop
 */
* Copyright (C), 2016
* SAS Institute Inc., Cary, N.C. 27513, U.S.A. All rights reserved.
***********************************************************************/
```
Set SAS environment variables that specify the location of the Hadoop Java client API and configuration files. They are used to access Hadoop services. The Java client API is provided by the Hadoop vendor in the form of JAR files.

NOTE: The SAS Contextual Analysis In-Database Scoring for Hadoop Administrator's Guide describes how to collect Hadoop Java client API jars and configuration files.

options set=SAS_HADOOP_JAR_PATH="C:\path\to\Hadoop\jars";
options set=SAS_HADOOP_CONFIG_PATH="C:\path\to\Hadoop\conf";

Execute a LIBNAME statement to assign a library reference to associate with a Hadoop HDFS or HIVE server.

Please contact your IT administrator for the HIVE server name.

libname gridlib hadoop server="hivenode.com" user=xxxxx password=xxxxxxx;

Execute a LIBNAME statement to assign a library reference to the location of the local SAS data set to be scored.

If all the data sets used for scoring are already in HDPS, the library might not be needed.

libname home "C:\path\to\local\dataset";

Copy the data set to HDFS. Unique observation IDs are required and are created as the field _document_id.

If all the data sets used for scoring are already in HDPS, this step might not be needed.

data gridlib.input_dataset;
    set home.input_dataset;
    _document_id = _N_;
run;

Set input/output macro variables.

input_ds: Name of input data set in Hadoop, including the HDFS libref
document_id: Name of the unique document ID column in the input data set
document_column: Name of the column to process in the input data set
liti_binary_path: Path to the LITI binary
output_ds: Name of the output data set, including the HDFS libref

NOTE: The SAS Contextual Analysis In-Database Scoring for Hadoop Administrator's Guide describes how to deploy Text Analytics models into clusters.

%let input_ds = gridlib.input_dataset;
%let document_id = _document_id;
%let document_column = text_to_process;
%let liti_binary_path = '/path/to/liti/binary.li';
%let output_ds = gridlib.concept_out;

/**************************************************************************
* Delete the output before starting (Optional)
***************************************************************************/
proc delete data=&output_ds; run;

/**************************************************************************
* Scores concepts in Hadoop
***************************************************************************/
proc ds2 ds2accel=yes xcode=warning;
/* These packages are part of the Text Analytics add-on and are installed */
/* in the EP */
require package tkcat; run;
require package tktxtanio; run;

/* The output of the thread program is the input of the data program */
THREAD workerth / overwrite=YES;

dcl package tkcat cat();
dcl package tktxtanio txtanio();

dcl binary(8)   _apply_settings;
dcl binary(8)   _document;
dcl binary(8)   _liti_binary;
dcl binary(8)   _trans;

dcl double      _status;
dcl double      _num_matches;
dcl double      _i;
dcl double      _document_id;
dcl varchar(1024) _name;
dcl varchar(1024) _full_path;
dcl double      _start_offset;
dcl double      _end_offset;
dcl varchar(1024) _term;
dcl varchar(1024) _canonical_form;

retain        _apply_settings;
retain        _liti_binary;
retain        _trans;

/**************************************************************************
* Initialization step. Only runs once when starting.
***************************************************************************/
method init();
  _apply_settings = cat.new_apply_settings();
  _liti_binary = txtanio.new_on_content_server(&liti_binary_path);

  _status = cat.set_apply_model(_apply_settings, _liti_binary);
  if _status NE 0 then put 'ERROR: set_apply_model fails';

  /* Match types are 0=ALL, 1=LONGEST or 2=BEST */
`_status = cat.set_match_type(_apply_settings, 0);
if _status NE 0 then put 'ERROR: set_match_type fails';

_status = cat.initialize_concepts(_apply_settings);
if _status NE 0 then put 'ERROR: initialize_concepts fails';

_trans = cat.new_transaction();
end;

/**********************************************************************
* Run step. The method runs per row of input.
**********************************************************************/
method run();
set &input_ds(keep=(&document_column &document_id));

/* Only process if document observation is not empty*/
if &document_column NE ' ' then do;

/* Initialize the document with the column data */
_document = txtanio.new_document_from_string(&document_column);

/* Set the document on the transaction so we're ready to process */
_status = cat.set_document(_trans, _document);
if _status NE 0 then put 'ERROR: set_document fails on obs:' &document_id;

/* Apply the binary to the document */
_status = cat.apply_concepts(_apply_settings, _trans);
if _status NE 0 then put 'ERROR: apply_concepts fails on obs:' &document_id;

/* Look for the concept matches */
_num_matches = cat.get_number_of_concepts(_trans);
_i = 0;
do while (_i LT _num_matches);
   _name = cat.get_concept_name(_trans, _i);
   _full_path = cat.get_full_path_from_name(_trans, _name);
   _start_offset = cat.get_concept_start_offset(_trans, _i);
   _end_offset = cat.get_concept_end_offset(_trans, _i);
   _term = cat.get_concept(_trans, _i);
   _canonical_form = cat.get_concept_canonical_form(_trans, _i);
   output;
   _i = _i + 1;
end;

/* Now look for fact matches */
_num_matches = cat.get_number_of_facts(_trans);
_i = 0;
_canonical_form = ''; 
do while (_i LT _num_matches);
   _name = cat.get_fact_name(_trans, _i);
   _full_path = cat.get_full_path_from_name(_trans, _name);
   _start_offset = cat.get_fact_start_offset(_trans, _i);
   _end_offset = cat.get_fact_end_offset(_trans, _i);
   _term = cat.get_fact(_trans, _i);
output;

_i = _i + 1;
end;
_i = 0;

/* Clean up resources */
cat.clean_transaction(_trans);
txtanio.free_object(_document);
end;
end;

/*====================================================================
** Termination step that runs only once at the end.
**====================================================================*/
method term();
  /* clean up resources */
cat.free_transaction(_trans);
cat.free_apply_settings(_apply_settings);
txtanio.free_object(_liti_binary);
end;
endthread;
run;

/*====================================================================
** Collect output data
**====================================================================*/
data &output_ds(
  keep=(
    &document_id
    _name
    _full_path
    _start_offset
    _end_offset
    _term
    _canonical_form
  )
  overwrite=yes
); dcl THREAD workerth THRD;

method run();
  set from THRD;
end;
enddata;
run; quit;

---

Using the Category Model

The following code can be executed in SAS Contextual Analysis In-Database Scoring for Hadoop for context categorization.
Set SAS environment variables that specify the location of the Hadoop Java client API and configuration files. They are used to access Hadoop services. The Java client API is provided by the Hadoop vendor in the form of JAR files.

NOTE: The SAS Contextual Analysis In-Database Scoring for Hadoop Administrator’s Guide denotes how to collect Hadoop Java client API jars and configuration files.

options set=SAS_HADOOP_JAR_PATH="C:\path\to\Hadoop\jars";
options set=SAS_HADOOP_CONFIG_PATH="C:\path\to\Hadoop\conf";

Execute a LIBNAME statement to assign a library reference to associate with a Hadoop HDFS or HIVE server.

Please contact your IT administrator for the HIVE server name.

libname gridlib hadoop server="hivenode.com" user=xxxxx password=xxxxxxx;

Execute a LIBNAME statement to assign a library reference to the location of the local SAS data set to be scored.

If all the data sets used for scoring are already in HDFS, the library may not be needed.

libname home "C:\path\to\local\dataset";

copy the data set to HDFS. Unique observation IDs are required and are created as the field _document_id.

If all the data sets used for scoring are already in HDFS, this step might not be needed.

data gridlib.input_dataset;
set home.input_dataset;
_document_id = _N_; run;

Set input/output macro variables.

input_ds: Name of input data set in Hadoop, including the HDFS libref
document_id: Name of the unique document ID column in the input data set
document_column: Name of the column to process in the input data set
liti_binary_path: Path to the LITI binary
output_ds: Name of the output data set, including the HDFS libref
* NOTE: The SAS Contextual Analysis In-Database Scoring for
  Hadoop Administrator's Guide describes how to deploy Text Analytics models
  into clusters.
******************************************************************************/
%let input_ds = gridlib.input_dataset;
%let document_id = _document_id;
%let document_column = text_to_process;
%let mco_binary_path = '/path/to/mco/binary.mco';
%let output_ds = gridlib.category_out;
*****************************************************************************/
* Delete the output before starting (Optional)  
******************************************************************************/
proc delete data=&output_ds; run;
*****************************************************************************/
* Score categories in Hadoop  
******************************************************************************/
proc ds2 ds2accel=yes xcode=warning;
/* These packages are part of the Text Analytics add-on and are installed */
/* in the EP  
require package tkcat; run;
require package tktxtanio; run;

/* The output of the thread program is the input of the data program */
THREAD workerth / overwrite=YES;
  dcl package tkcat cat();
  dcl package tktxtanio txtanio();
  dcl binary(8) _apply_settings;
  dcl binary(8) _document;
  dcl binary(8) _mco_binary;
  dcl binary(8) _trans;
  dcl double _status;
  dcl double _num_matches;
  dcl double _num_terms;
  dcl double _i;
  dcl double _j;
  dcl double _document_id;
  dcl varchar(1024) _name;
  dcl varchar(1024) _full_path;
  dcl double _start_offset;
  dcl double _end_offset;
  dcl varchar(1024) _term;
  retain _apply_settings;
  retain _mco_binary;
  retain _trans;

/ *************************************************************************/
* Initialization step. Runs only once when starting.  
******************************************************************************/
method init();

Using the Category Model 9
_apply_settings = cat.new_apply_settings();
_mco_binary = txtanio.new_on_content_server(&mco_binary_path);
cat.set_categories_model(_apply_settings, _mco_binary);
cat.set_return_match_positions_for_categories(_apply_settings, 1);
cat.set_relevancy_type(_apply_settings, 1);
_status = cat.initialize_categories(_apply_settings);
if _status NE 0 then put 'ERROR: initialize_categories fails';

_trans = cat.new_transaction();
end;

/* Run step. The method runs per row of input. ***********************/
method run();
  set &input_ds(keep=(&document_column &document_id));
  /* Only process if document observation is not empty*/
  if &document_column NE ' ' then do;
    /* Initialize the document with the column data */
    _document = txtanio.new_document_from_string(&document_column);
    /* Set the document on the transaction so we're ready to process */
    _status = cat.set_document(_trans, _document);
    if _status NE 0 then put 'ERROR: set_document fails on obs:' &document_id;
    /* Apply the binary to the document */
    _status = cat.apply_categories(_apply_settings, _trans);
    if _status NE 0 then put 'ERROR: apply_categories fails on obs:' &document_id;
    /* Get the number of categories matches */
    _num_matches = cat.get_nb_matched_categories(_trans);
    _i = 0;
    do while (_i LT _num_matches);
      /* we used the name for both name & full_path for better alignment */
      /* with LITI code */
      _name = cat.get_category_name(_trans, _i);
      _full_path = _name;
      /* Get the number of term matches for current matched category */
      _num_terms = cat.get_nb_matched_terms_category(_trans, _i);
      _j = 0;
      do while (_j LT _num_terms);
        _start_offset = cat.get_matched_term_start_offset_category(_trans, _i, _j);
        _end_offset = cat.get_matched_term_end_offset_category(_trans, _i, _j);
        _term = cat.get_matched_term_category(_trans, _i, _j);
        output;
        _j = _j + 1;
      end;
      _i = _i + 1;
    end;
  end;
Using the Sentiment Model

The following code can be executed in SAS Contextual Analysis In-Database Scoring for Hadoop for analyzing sentiment.

/*****************************************************************************
* Sentiment score code for Hadoop
 ****************************************************************************/
* Copyright (C), 2016  
  
  SAS Institute Inc., Cary, N.C. 27513, U.S.A.  All rights reserved.
Set SAS environment variables that specify the location of the Hadoop Java client API and configuration files. They are used to access Hadoop services.

*NOTE: The SAS Contextual Analysis In-Database Scoring for Hadoop Administrator's Guide denotes how to collect Hadoop Java client API jars and configuration files.*

```
options set=SAS_HADOOP_JAR_PATH="C:\path\to\Hadoop\jars";
options set=SAS_HADOOP_CONFIG_PATH="C:\path\to\Hadoop\conf";
```

Execute a LIBNAME statement to assign a library reference to associate with a Hadoop HDFS or HIVE server.

*Please contact your IT administrator for the HIVE server name.*

```
libname gridlib hadoop server="hivenode.com" user=xxxxx password=xxxxxxx;
```

Execute a LIBNAME statement to assign a library reference to the location of the local SAS data set to be scored.

*If all the data sets used for scoring are already in HDFS, the library might not be needed.*

```
libname home "C:\path\to\local\dataset";
```

Copy the data set to HDFS. Unique observation IDs are required and are created as the field _document_id.

*If all the data sets used for scoring are already in HDFS, this step might not be needed.*

```
data gridlib.input_dataset;
  set home.input_dataset;
  _document_id = _N_; 
run;
```

Set input/output macro variables.

*NOTE: The SAS Contextual Analysis In-Database Scoring for Hadoop Administrator's Guide describes how to deploy Text Analytics models into clusters.*

```
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```
%let input_ds = gridlib.input_dataset;
%let document_id = _document_id;
%let document_column = text_to_process;
%let sam_binary_path = /path/to/sam/binary.sam';
%let output_ds = gridlib.sentiment_out;

******************************************************************************
* Delete output before starting (Optional)
******************************************************************************
proc delete data=&output_ds; run;

******************************************************************************
* Scores sentiment in Hadoop
******************************************************************************
proc ds2 ds2accel=yes xcode=warning;

    /* These packages are part of the Text Analytics add-on and are installed */
    /* in the EP */
    require package tkling; run;
    require package tksent; run;
    require package tktxtanio; run;

    /* The output of the thread program is the input of the data program */
    THREAD workerth / overwrite=YES;

        dcl package tkling ling();
        dcl package tksent sent();
        dcl package tktxtanio txtanio();

        dcl binary(8) _apply_settings;
        dcl binary(8) _document;
        dcl binary(8) _sam;
        dcl binary(8) _trans;
        
        dcl double _status;
        dcl char(10) _sentiment;
        dcl double _sentiment_probability;

        retain _apply_settings;
        retain _sam_binary;
        retain _trans;

    /******************************************************************************
    * Initialization step. Runs only once when starting.
    ******************************************************************************

    method init();
        _status = ling.set_language('english');
        if _status NE 0 then put 'ERROR: set_language fails';

        _status = ling.set_default_language_data();
        if _status NE 0 then put 'ERROR: set_default_language_data fails';

        _apply_settings = sent.new_apply_settings();
        if _status NE 0 then put 'ERROR: set_threshold fails';
_sam = txtanio.new_on_content_server(&sam_binary_path);

_status = sent.set_model(_apply_settings, _sam);
if _status NE 0 then put 'ERROR: set_model fails';

_trans = sent.new_transaction();

_status = sent.initialize_sentiment(_apply_settings, _trans);
if _status NE 0 then put 'ERROR: initialize_sentiment fails';
end;

/******************************************************************************
* Run step. The method runs per row of input.
*******************************************************************************/
method run();
set &input_ds(keep=(&document_column &document_id));

/* Only process if document observation is not empty*/
if &document_column NE '' then do;

/* Initialize the document with the column data */
_document = txtanio.new_document_from_string(&document_column);

/* Set the document on the transaction so we're ready to process */
_status = sent.set_document(_trans, _document);
if _status NE 0 then put 'ERROR: set_document fails on document:' &document_id;

/* Apply the binary to the document */
_status = sent.apply_sentiment(_apply_settings, _trans);
if _status NE 0 then put 'ERROR: apply_sentiment fails on document:' &document_id;

/* Get current document sentiment polarity and probability */
_sentiment = sent.get_sentiment(_trans);
_sentiment_probability = sent.get_probability(_trans);
output;

/* Clean up resources */
    sent.clean_sentiment(_trans);
    txtanio.free_object(_document);
end;
end;

/******************************************************************************
* Termination step. Runs only once at end.
*******************************************************************************/
method term();
/* clean up resources */
    sent.free_transaction(_trans);
    sent.free_apply_settings(_apply_settings);
    txtanio.free_object(_sam);
end;
endthread;
run;
/**********************************************************************/
* Collect output data
***********************************************************************/
data &output_ds(
    keep=
    
    &document_id
    _sentiment
    _sentiment_probability
    
    overwrite=yes
    );
dcl THREAD workerth THRD;

    method run();
        set from THRD;
    end;

enddata;
run; quit;
Recommended Reading

- *SAS Contextual Analysis: Administrator’s Guide*
- *SAS Contextual Analysis: User’s Guide*
- *SAS Contextual Analysis In-Database Scoring for Hadoop: User’s Guide*
- *SAS In-Database Products: Administrator’s Guide*
- *SAS In-Database Products: User’s Guide*

For a complete list of SAS publications, go to [sas.com/store/books](http://sas.com/store/books). If you have questions about which titles you need, please contact a SAS Representative:

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Cary, NC 27513-2414  
Phone: 1-800-727-0025  
Fax: 1-919-677-4444  
Email: sasbook@sas.com  
Web address: [sas.com/store/books](http://sas.com/store/books)
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