



# Advanced GATE Applications



# Topics covered

- This module is about adapting ANNIE to create your own applications, and to look at more advanced techniques within applications
  - Using different gazetteers
  - Adapting ANNIE to different languages
  - Using conditional applications
  - Section-by-section processing
  - Using multiple annotation sets
  - Separating useful content in a document
  - Schema Enforcer
  - Using Groovy
  - Modular Pipelines

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# Using different gazetteers



## Why?

- The standard gazetteer in ANNIE only performs exact matching against the text
- An entry in a gazetteer list must match the word exactly in the text (with the exception of capitalisation issues depending on if the case-sensitive parameter is switched on)
- But what if we want to match a plural word in the text with a singular word in the gazetteer?
- Or different forms of a verb (says, saying, say, said etc.)
- It would be nice not to have to specify alternative forms of each word in the lists
- Luckily, we have ways to do this

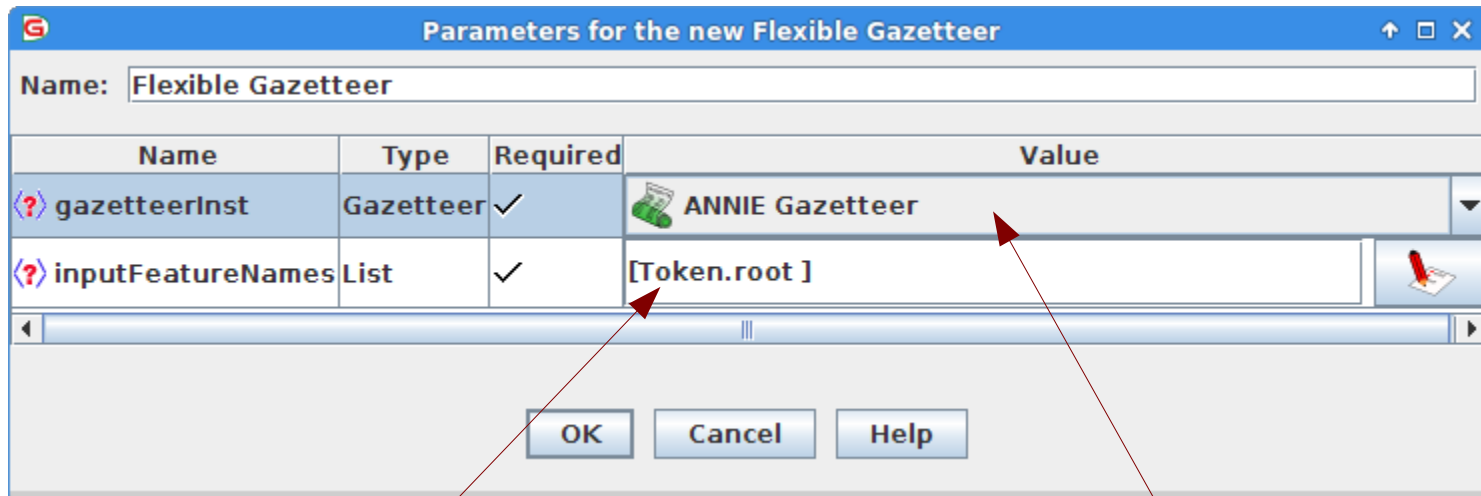
# Advanced Gazetteers

- There are several different gazetteers which let you do more complex matching
  - **Flexible Gazetteer:** enables matching against features on an annotation (typically the Token's root feature)
  - **Feature Gazetteer:** enables matching against features on an annotation, but also enables adding/removing annotations and features when a match is found
  - **Extended Gazetteer:** as for the flexible gazetteer, but also provides features for more powerful matching of partial words, annotating prefixes and suffixes, and more versatile handling of word boundaries and white space.
  - **BWP Gazetteer:** approximate gazetteer based on Levenshtein Edit Distance for strings, aiming to handle text with noise and errors

# Flexible Gazetteer

- Found in the Tools plugin
- Requires a regular gazetteer to be loaded - this should not be in the pipeline, however
- Load-time parameters let you specify:
  - the regular gazetteer to use
  - the annotations and features to match on
- The typical use for this is to match against the root form of a word (e.g. dogs -> dog; laughing -> laugh)
- To do this, you need to specify `Token.root` as the annotation and feature to match on
- You also need to make sure you have run the morphological analyser first, so you have root features on your Tokens

# Flexible gazetteer load-time parameters



Choose the annotation name and feature that you want to match on

Select a gazetteer that you have loaded, e.g. the default ANNIE one

# Hands-on with flexible gazetteer

- Load ANNIE
- Load the Tools plugin
- Create a new Flexible Gazetteer, and select Token.root as the input Feature name
- Select the ANNIE gazetter as the gazetter instance to use
- Create a new morphological analyser
- Go to the ANNIE application and add the morphological analyser and flexible gazetter to the pipeline after the POS tagger
- Remove the ANNIE gazetter from the application (but don't remove it from GATE!)
- Try it on some text!



# Extended Gazetteer

- Found in the StringAnnotation plugin Plugin Repository “Additional Plugins from the GATE Team” or download from <https://github.com/johann-petrak/gateplugin-StringAnnotation>
- Faster loading, uses much less memory than regular gazetteer
- Needs annotations that identify words and whitespace
- Can limit annotating to just within containing annotations
- Same PR can be used for direct matching of document text or indirect matching of feature values
- Can specify whether to match at the beginning and/or the end of words separately
- Can use (gzip) compressed list files (.lst.gz)

# Init parameters

- **caseSensitive**: false if case should be ignored for matching
- **configFile URL**: specify the definition/config file – similar to the “listsURL” parameter on the ANNIE gazetteer
- **caseConversionLanguage**: Specify the language to use for converting characters to upper case when case-insensitive matching (e.g. ß → SS for de) . Default is [en](#) (English)
- **gazetteerFeatureSeparator**: same as for the ANNIE gazetteer
- => no encoding parameters, list files have to be UTF-8 encoded

# Run-time parameters

- **containingAnnotationType**: if an annotation type is given, then matching is done only fully within the span of such annotations. E.g. DocumentContent, Sentence.
- **longestMatchOnly**: if set to true, then only the longest match is used and all shorter matches are ignored.
- **matchAtWordEndOnly**: if true, then the end of a match can only occur at the end of a word annotation. Typically set to [true](#).
- **matchAtWordStartOnly**: if true, then the start of a match can only occur at the start of a word annotation. Typically set to [true](#).
- **textFeature**: feature of the word annotation to match on (as for FlexibleGazetteer). Typically left empty or set to [root](#).

# More run-time parameters

- **outputAnnotationType**: in case you want to change the name of the annotation to be created on a match (instead of Lookup)
- **spaceAnnotationType**: the annotation type that identifies space between words, default is [SpaceToken](#).
- **splitAnnotationType**: the annotation type that identifies positions in the document that should not be crossed by matches, default is [Split](#).
- **wordAnnotationType**: type of annotations that define the word boundaries of the text that should be used for matching or if matching by feature is used, the annotations containing the feature. Typically set to [Token](#).

## Extended gazetteer cache files

- When a gazetteer is first loaded from a .def file, then the ExtendedGazetteer will create a new gazetteer cache file.
- This cache file has the same name as the .def file but with a file extension ".gazbin" instead of ".def".
- When the gazetteer gets loaded and such a cache file exists, the cache file will be loaded instead of the original files.
- NOTE: if a cache file exists, it will always be used, no matter if the .def or any .lst file has been changed in the meantime. If you update the gazetteer, make sure you select "Remove cache and re-initialise" in the GUI

# Feature gazetteer

- Found in the StringAnnotation plugin
- Enables adding/removing annotations/features when a match is found
- For example, if tokens have a root feature and there is a gazetteer list that has as a feature the frequencies of English word roots in some corpus, the "add features" action can be used to enrich the token annotations with word frequencies.
- **filter annotations:** if there is a gazetteer of stopwords, the string or root feature of existing token annotations can be matched and the "remove annotation" action can be used to remove these annotations if a stopword is matched.

# Init parameters

- exactly the same as for the ExtendedGazetteer
- Note: this gazetteer uses the cache, .def and .lst files in exactly the same way as the ExtendedGazetter. If the ExtendedGazetteer and/or FeatureGazetteer load from the same files using the same Init-parameters, only one shared copy is used in memory.



# Feature gazetteer run-time parameters

- **containingAnnotationType**: If an annotation type is given, then matching is done only within the span of such annotations.
- **InputAnnotationSet**: the set that contains the annotations to be updated, if annotations are updated
- **matchAtStartOnly**: if true, then a match must be found at the start of the value of the feature, if false, a match may start anywhere.
- **matchAtEndOnly**: if true, then a match must be found that ends at the end of the value of the feature, if false, a match may end anywhere.
- **outputAnnotationType**: in case you want to change the name of the annotation to be created on a match, if annotations are created (instead of Lookup)





## More run-time parameters

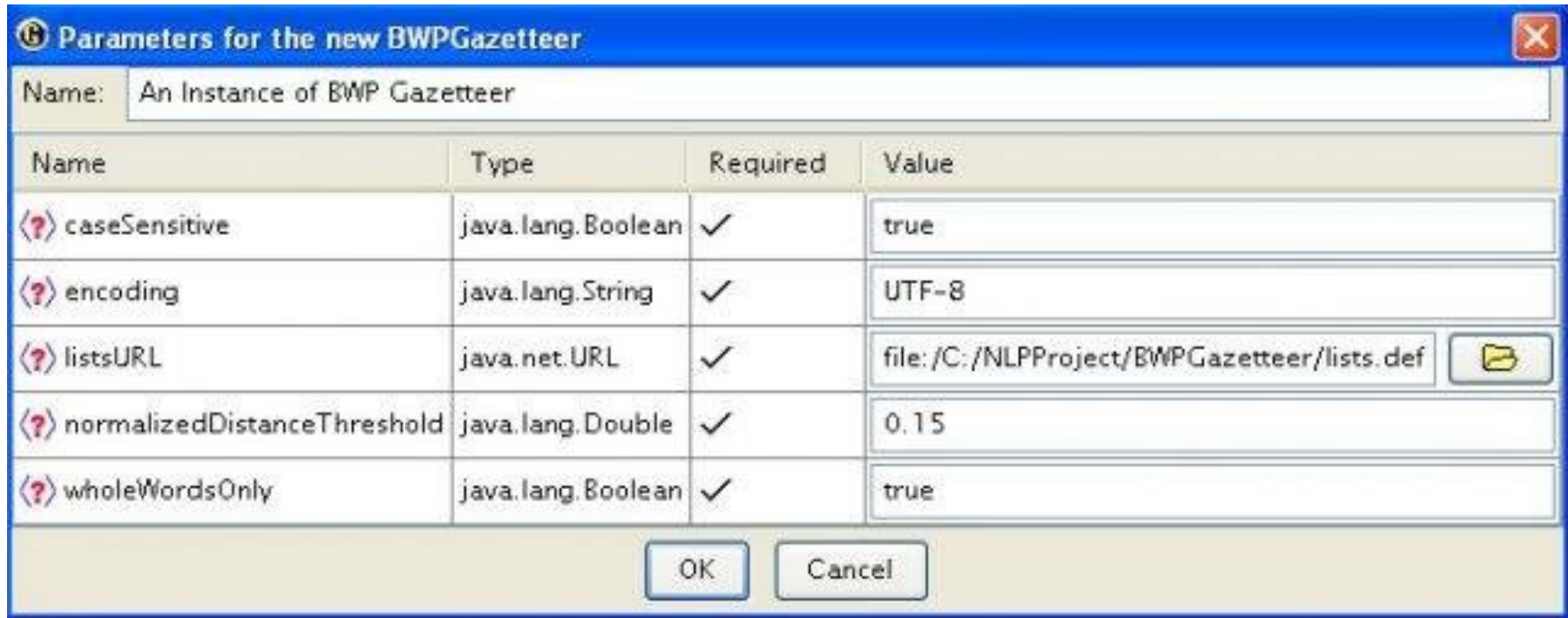
- **wordAnnotationType**: the annotation type that is used for matching. For example [Token](#) or [Lookup](#).
- **textFeature**: the name of a feature of the word annotation which is used for matching, e.g. [root](#) or [id](#)
- **processingMode**: select an option from:
  - **AddFeatures**: add all features from the def file or the gazetteer entry which are not already present in the annotation
  - **OverwriteFeatures**: overwrite all features (if any existing) from the def file or the gazetteer entry with the new values
  - **RemoveAnnotation**: delete the annotation from the input AS
  - **AddNewAnnotation**: add a new annotation to the output AS
  - **KeepAnnotation**: keep annotation if match, else remove

# Gazetteer features

- All GATE gazetteers allow arbitrary feature values to be associated with particular entries in a single list
- ANNIE does not use this capability, but to enable it for your own gazetteers, set the optional `gazetteerFeatureSeparator` parameter
- We advise setting the value of this feature to the tab character (`\t`) so that it is never confused with part of a list entry
- It also means you can directly use tab-separated value (`.tsv`) files from your favourite spreadsheet editor
- You do not have to provide the same features for every line in the file, e.g. you can provide extra features for some lines in the list but not others.
- Use the “+cols” option in the GATE gazetteer editor to add new sets of features and values


# BWP gazetteer

- Does not come with GATE, but can be loaded as a plugin
- Download from <http://sourceforge.net/projects/bwp-gazetteer/>



Parameters for the new BWP Gazetteer

Name: An Instance of BWP Gazetteer

Name	Type	Required	Value
<a href="#">(?)</a> caseSensitive	java.lang.Boolean	✓	true
<a href="#">(?)</a> encoding	java.lang.String	✓	UTF-8
<a href="#">(?)</a> listsURL	java.net.URL	✓	file:/C:/NLPPProject/BWPGazetteer/lists.def 
<a href="#">(?)</a> normalizedDistanceThreshold	java.lang.Double	✓	0.15
<a href="#">(?)</a> wholeWordsOnly	java.lang.Boolean	✓	true

OK Cancel

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# Developing IE for other languages



# Finding available resources

- When creating an IE system for new languages, it's easiest to start with ANNIE and then work out what needs adapting
- Check the resources in GATE for your language (if any)
  - Check the gate/plugins directory (hint: the language plugins begin with Lang\_\*)
  - Check the user guide for things like POS taggers and stemmers which have various language options
- Check which PRs you can reuse directly from ANNIE
  - Existing tokeniser and sentence splitter will work for most European languages. Asian languages may require special components.
- Collect any other resources for your language, e.g POS taggers. These can be implemented as GATE plugins.



# Language plugins available

The screenshot shows the CREOLE Plugin Manager window. It has a title bar with a close button. Below the title bar are four tabs: 'Installed Plugins', 'Available Updates', 'Available to Install', and 'Configuration'. The 'Installed Plugins' tab is active. Below the tabs is a section for 'CREOLE Plugin Directories' with a '+' and '-' button and a 'Filter:' text box. The main area is a table with columns for 'Load Now', 'Load Always', and 'Plugin Name'. The 'Lang\_Arabic' plugin is selected, and its resources are listed in a pane on the right.

	Load Now	Load Always	Plugin Name
			C:\gate\plugins\keyphrase_extraction_algorithm
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Arabic C:\gate\plugins\Lang_Arabic
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Bulgarian C:\gate\plugins\Lang_Bulgarian
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Cebuano C:\gate\plugins\Lang_Cebuano
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Chinese C:\gate\plugins\Lang_Chinese
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_French C:\gate\plugins\Lang_French
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_German C:\gate\plugins\Lang_German
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Hindi C:\gate\plugins\Lang_Hindi
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Romanian C:\gate\plugins\Lang_Romanian
	<input type="checkbox"/>	<input type="checkbox"/>	Lang_Russian C:\gate\plugins\Lang_Russian
	<input type="checkbox"/>	<input type="checkbox"/>	Language_Identification C:\gate\plugins\Language_Identification

Resources in Plugin

- Arabic Gazetteer Collector
- Arabic Gazetteer
- Arabic IE System
- Arabic Inferred Gazetteer
- Arabic OrthoMatcher
- Arabic Tokeniser
- Arabic Main Grammar

Buttons: Help, Apply All, Close

## Which resources need modifying?

We can divide the PRs into 3 types depending on how much modification they need to work with other languages:

- **language-independent:** work with different languages with little or no modification
- **easily modifiable:** can be easily modified for a different language with little programming skill
- **language-dependent:** these need to be replaced by an entirely new PR

## Language-independent resources

- ANNIE PRs which are totally language-independent are the **Document Reset** and **Annotation Set Transfer**
- They can be seen as “language-agnostic” as they just make use of existing annotations with no reference to the document itself or the language used
- The **tokeniser** and **sentence splitter** are (more or less) language-independent and can be re-used for languages that have the same notions of token and sentence as English (white space, full stops etc)
- Make sure you use the Unicode tokeniser, not the English tokeniser (which is customised with some English abbreviations etc)
- Some tweaking could be necessary - these PRs are easy to modify (with no Java skills needed)



# Easily modifiable resources

- **Gazetteers** are normally language-dependent, but can easily be translated or equivalent lists found or generated
  - Lists of numbers, days of the week etc. can be translated
  - Lists of cities can be found on the web
- Gazetteer modification requires no programming or linguistic skills
- The **Orthomatcher** will work for other languages where similar rules apply, e.g. John Smith --> Mr Smith
- Might need modification in some cases: some basic Java skills and linguistic knowledge are required

# Language-dependent resources

- **POS taggers** and **grammars** are highly language-dependent
- If no POS tagger exists, a hack can be done by replacing the English lexicon for the Hepple tagger with a language-specific one
- Some grammar rules can be left intact, but many will need to be rewritten
- Many rules may just need small modifications, e.g. component order needs to be reversed in a rule
- Knowledge of some linguistic principles of the target language is needed, e.g. agglutination, word order etc.
- No real programming skills are required, but knowledge of JAPE and basic Java are necessary

## Adding a POS tagger for a new language

- If you already have a POS tagger for your language with a Java API, you can write a “wrapper” PR for it
  - This enables you to feed sentences/tokens to the tagger, and map the output back to GATE annotations
  - See the `Parser_Stanford` plugin for an example of this.
- If you have a POS-tagged corpus, you could translate it into “traditional” tagged format with one line per sentence, e.g.  
*The\_DT cat\_NN sat\_VBD on\_IN the\_DT mat\_NN .\_\_.*
  - You can then use the resulting trained model as a parameter for the LingPipe POS Tagger PR
  - This is how we POS-tagged Bulgarian in GATE

# Tree Tagger



- Language-independent POS tagger supporting English, French, German, Spanish in GATE
- Needs to be installed separately
- Also supports Italian and Bulgarian, but not in GATE
- Tagger framework should be used to run the TreeTagger
- This provides a generic wrapper for various taggers
- In addition to TreeTagger, sample applications for
  - GENIA (English biomedical tagger)
  - HunPos (English and Hungarian)
  - Stanford Tagger (English, German and Arabic)
- More details in the GATE User Guide

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# Conditional Processing

# What is conditional processing?

- In GATE, you can set a processing resource in your application to run or not depending on certain circumstances
- You can have several different PRs loaded, and let the system automatically choose which one to run, for each document.
- This is very helpful when you have texts in multiple languages, or of different types, which might require different kinds of processing
- For example, if you have a mixture of German and English documents in your corpus, you might have some PRs which are language-dependent and some which are not
- You can set up the application to run the relevant PRs on the right documents automatically.

# Conditional processing with different languages



- Suppose we have a corpus with documents in German and English, and we only want to process the English texts.
- First we must distinguish between the two kinds of text, using a language identification tool
- For this we can use TextCat, which is a GATE plugin
- We use this (in default mode) to add a feature on each document, telling us which language the document is in
- Then we run a conditional processing pipeline, that only runs the subsequent PRs if the value of the language feature on the document is English
- The other documents will not be processed



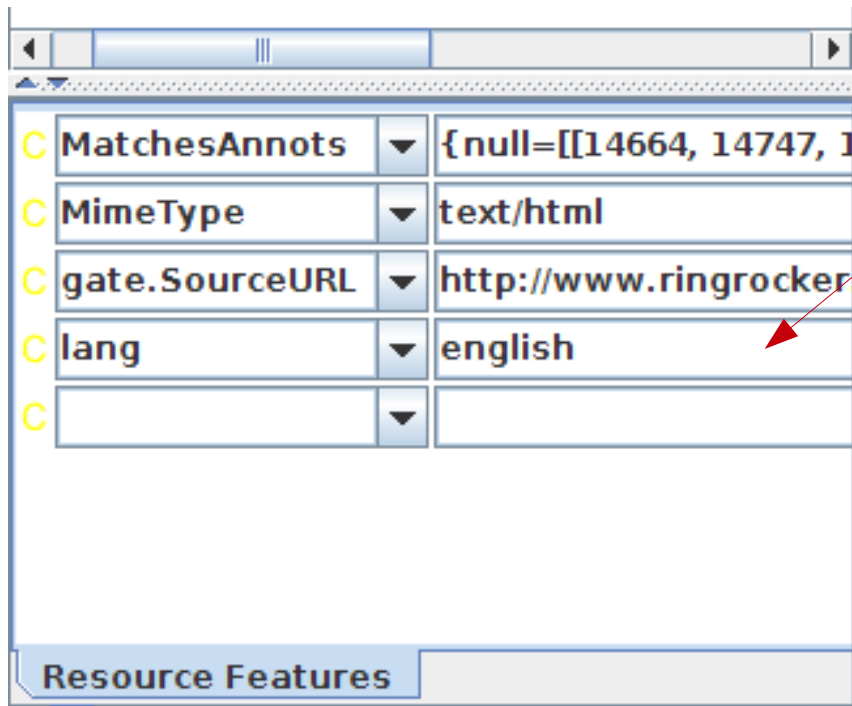
# Hands-on with multilingual corpora (1)

- Create a new corpus in GATE and populate it with the two documents found in `corpus/rar-english-german-corpus/`
- Select `iso-8859-1` as the encoding when you populate the corpus
- You should have one English and one German document loaded
- Load ANNIE
- Load the Language Identification plugin and load the TextCat Language Identification PR
- Add TextCat to the end of the ANNIE application and run it on the corpus
- You should get some sensible annotations for the English document and some slightly less sensible ones for the German one



# Check the language of the documents

- Click on a document
- In the bottom left corner is the document features pane
- TextCat will add a language feature here



# What if we want to process the German too?



- If we want to process both German and English documents with different resources, we have a couple of options
  1. We can just call some language-specific PRs conditionally, and use the language-neutral PRs on all documents
  2. We can call different applications from within the main application
- The following two hands-on exercises demonstrate the difference between these



# Hands-on with multilingual apps (1)

- Load the application `annie+german.gapp`
- Look at the various PRs in the app: some are set to run on English documents, some on German ones, and some on all documents
- Run the application on your corpus
- The German document should now be annotated with German NEs and the English document with English ones
- There will be some mistakes (we're not using a German POS tagger here so results are weaker than usual)



## Hands-on with multilingual apps (2)

- Close recursively all applications you have loaded in GATE (keep the corpus)
  - Load ANNIE with defaults
  - Load the Lang\_German plugin
  - Load the German IE application from “Ready-made applications”
  - Create a new conditional corpus pipeline
  - Load a TextCat PR and add it to the new pipeline created
  - Add the ANNIE and German **applications** to the pipeline (in either order) after the TextCat
- Set ANNIE to run on English documents and the German app to run on German ones
- Save the main application and run it on your corpus



# Your application should look like this

Messages Conditional Cor...

Loaded Processing resources

Name	
ANNIE NE Transducer	ANNIE NE Transdu
ANNIE OrthoMatcher	ANNIE OrthoMatch
ANNIE POS Tagger	ANNIE POS Tagge
ANNIE Sentence Splitter	ANNIE Sentence S
Document Reset PR	Document Reset I
compound analysis gazetteer	ANNIE Gazetteer
german gazetteer	ANNIE Gazetteer
german grammar	JAPE Transducer
orthomatcher	ANNIE OrthoMatch
reset	Document Reset I
splitter	ANNIE Sentence S
tokeniser	GATE Unicode Tok
tokeniser postprocessor	JAPE Transducer

Selected Processing resources

!	Name	
	TextCat Language Identification_00020	TextCat L.
	ANNIE	Corpus Pi
	German NE without POS tagging	Condition

Run "German NE without POS tagging"?

Yes  No  If value of feature  is

Corpus:

Runtime Parameters for the "German NE without POS tagging" Conditional Corpus Pipeline:

Name	Type	Required	Value
------	------	----------	-------



# Other uses for conditional processing

































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- Processing degraded text along with normal text
- For degraded text (e.g. emails, ASR transcriptions) you might want to use some case-insensitive PRs
- Another use is in combination with different kinds of files (HTML, plain text etc) which might require different processing
- More about this later....

# Another example

- In one application we developed, we found a problem when running the Orthomatcher (co-reference) on certain texts where there were a lot of annotations of the same type.
- To solve this issue, we first checked to see how many annotations of each were present in a document
- If more than a certain number were present, we added a document feature indicating this
- We then set the orthomatcher to only run on a document which did not contain this feature.

# Application

	 ANNIE Gazetteer	ANNIE Gazetteer
	 Government Gazetteer (Case ...	ANNIE Gazetteer
	 Government Gazetteer (Case ...	ANNIE Gazetteer
	 LKB Gazetteer	Large KB Gazetteer
	 Convert LKB Lookups	Jape Transducer
	 ANNIE NE Transducer	JAPE-PDA-Plus Transduce
	 Noun Phrase Chunker	Noun Phrase Chunker
	 Document Tagger	JAPE-PDA-Plus Transduce
	 Government Tagger	JAPE-PDA-Plus Transduce
	 Measurement Tagger	Measurement Tagger
	 Date Normalizer	Date Normalizer
	 Run Orthomatcher?	JAPE-PDA-Plus Transduce
	 ANNIE OrthoMatcher	ANNIE OrthoMatcher
	 TNA Instance Generator	TNA Instance Generator
	 Instance Fixer	JAPE-PDA-Plus Transduce
	 Produce Final Output	Schema Enforcer



# Grammar to check number of annotations

*If there are more than 200 annotations of one type, don't run the orthomatcher*

## Rule: CheckAnnotations

```
{Person} | {Organization} | {Location}
```

```
-->
{
AnnotationSet annots = inputAS.get("Person");
if (annots.size() > 200) {
doc.getFeatures().put("runOrthomatcher", "false");
return;}
...
doc.getFeatures().put("runOrthomatcher", "true");
}
```

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# **Section by Section Processing: the Segment Processing PR**

# What is it?



- PR which enables you to process labelled sections of a document independently, one at a time
- Useful for
  - very large documents
  - when you want annotations in different sections to be independent of each other
  - when you only want to process certain sections within a document

# Processing large documents

- If you have a very large document, processing it may be very slow
- One solution is to chop it up into smaller documents and process each one separately, using a datastore to avoid keeping all the documents in memory at once
- But this means you then need to merge all the documents back afterwards
- The Segment Processing PR does this all in one go, by processing each labelled section separately
- This is quicker than processing the whole document in one go, because storing a lot of annotations (even if they are not being accessed) slows down the processing

# Processing Sections Independently

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- Another problem with large documents can arise when you want to handle each section separately
- You may not want annotations to be co-referenced across sections, for instance if a web page has profiles of different people with similar names
- Using the Segment Processing PR enables you to handle each section separately, without breaking up the document
- It also enables you to use different PRs for each section, using a conditional controller
- For example, some documents may have sections in different languages

# Problematic co-references

Annotation Sets   Annotations List   Annotations Stack   Class   **Co-reference Editor**   Instance   Text

Sets : Default

Types : FirstPerson   Show

Co-reference Data

♀ Default

- Google Japan
- Koichiro TsujinoPresident &
- Stanford Law School
- Dennis Woodside
- Dennis G. Jacobs
- Japan
- Russia

Dennis Woodside  
Vice President, Americas Operations

Dennis joined Google in 2003 and leads the company's North American and Latin American advertising sales and operations teams. Previously, he oversaw Google's sales and operations in the U.K., Benelux and Ireland. Prior to that, Dennis launched and ran Google's field operations in Central Europe, Russia, the Middle East and North Africa. He established offices in 10 countries including Egypt, Turkey, Russia and Israel. Additionally, he started the company's inside sales operation in Europe.

Prior to joining Google, Dennis was an associate partner at McKinsey and Company, where he led operational and strategy projects for multinational clients in the technology and media industries. Earlier, he managed complex mergers and acquisitions in aerospace, energy, media and finance industries. He also served as law clerk to the Honorable Dennis G. Jacobs in the U.S. Court of Appeals for the 2nd Circuit in New York.

Dennis received a J.D. from Stanford Law School, where he was associate editor of the Stanford Law Review, and holds a bachelor's degree in industrial relations from Cornell University.

Legal

# Getting rid of the junk

- Another very common problem is that some documents contain lots of “junk” that you don't want to process, e.g. HTML files contain javascript or contents lists, footers etc.
- There are a number of ways in which you can do this: you may need to experiment to find the best solution for each case
  - **Segment Processing** PR enables you to only process the section(s) you are interested in and ignore the junk
  - Using the **AnnotationSetTransfer** PR, though this works slightly differently
  - Using the **Boilerpipe** PR - this works best for ignoring standard kinds of boilerplate



# How does it work?

- The PR is part of the Alignment Plugin
- A new application needs to be created, containing the Segment PR
- The PR then takes as one of its parameters, an instance of the application that you want to run on the document (e.g. ANNIE)
- You can add other PRs before or after the Segment PR, if you want them to run over the whole document rather than the specified section(s)



# Running ANNIE on a title segment

Messages **segment**

Loaded Processing resources

Name	Type
ANNIE	Corpus Pipeline
ANNIE Gazetteer	ANNIE Gazetteer
ANNIE NE Transducer	ANNIE NE Transducer
ANNIE OrthoMatcher	ANNIE OrthoMatcher
ANNIE POS Tagger	ANNIE POS Tagger

Selected Processing resources

Name	Type
Reset	Document Reset PR
get-bold grammar	ANNIE NE Transducer
Tokeniser	ANNIE English Tokeniser
Splitter	ANNIE Sentence Splitter
get-person grammar	ANNIE NE Transducer
Segment Processing PR_00023	Segment Processing PR

Run "Segment Processing PR\_00023"?

Yes  No  If value of feature  is

Corpus: Corpus for execs2.html\_0001A

Runtime Parameters for the "Segment Processing PR\_00023" Segment Processing PR:

Name	Type	Required	Value
analyser	LanguageAnalyser	✓	ANNIE
inputASName	String		Original markups
segmentAnnotationFeatureName	String		
segmentAnnotationFeatureValue	String		
segmentAnnotationType	String	✓	title







Run this Application

- Application contains a Segment Processing PR

- Segment Processing PR calls ANNIE application

# Segment Processing Parameters

Runtime Parameters for the "Segment Processing PR\_00023" Segment Processing PR: —

Name	Type	Required	Value
 analyser	LanguageAnalyser	✓	 ANNIE
 inputASName	String		Original markups
 segmentAnnotationFeatureName	String		
 segmentAnnotationFeatureValue	String		
 segmentAnnotationType	String	✓	title

- Segment Processing PR calls the ANNIE application
- ANNIE is set to run only on the text covered by the span of the “title” annotation in the Original markups annotation set

# Annotation Result



Annotation Sets Annotations List Annotations Stack Class Co-reference Editor Instance Text

BBC News - Snow strands lorries on motorway

Snow strands lorries on motorway

Motorists in the Denny area were forced to dig their cars out from snow

Ten lorries were stranded for several hours as snow, rain and strong winds made driving conditions difficult across many parts of Scotland.

The lorries were travelling south on the M90, close to Bridge of Earn in Perthshire, when they became stuck in about 7.5cm (3in) of snow.

Type	Set	Start	End	Id	Features
Organization		0	8	5094	{orgType=[null], rule1=TheOrgXKey, r
title	Original markups	0	43	2	{}

Lookup  
 Organization  
 SpaceToken  
 Token  
 Unknown  
 Original markups  
 b  
 body  
 head  
 p  
 title  
 ul

- Green shading shows the title, which spans the section to be annotated
- The only NE found is the Organization “BBC News” in the title
- Tokens in the rest of the document are not annotated

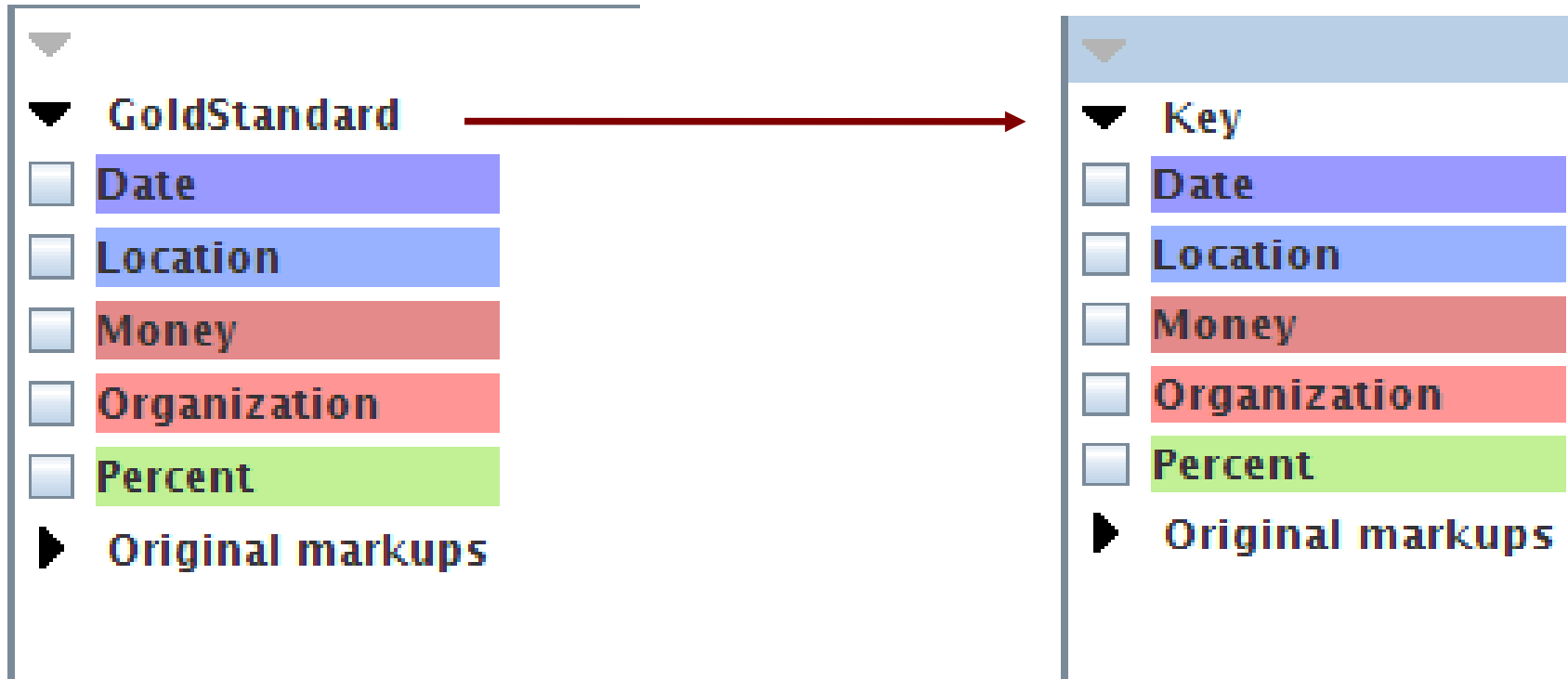
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# Using multiple annotation sets

# Annotation Set Transfer

- This PR enables copying or moving annotations from one set to another
- As with the Segment Processing PR, you can specify a covering annotation to delimit the section you're interested in
- One use for this is to change annotation set names or to move results into a new set, without rerunning the application
- For example, you might want to move all the gold standard annotations from Default to Key annotation set

# Transferring annotations



The annotations remain the same, they're just stored in a different set

# Hands-on Exercise

- Objective: move all the annotations from the Default set into the Key set
- Clear GATE of all previous documents, corpora, applications and PRs
- Load document self-shearing-sheep-marked.xml and create an instance of an AST (you may need to load the Tools plugin)
- Have a look at the annotations in the document
- Add the AST to a new application and set the parameters to move all annotations from Default to Key
- Make sure you don't leave the originals in Default!
- Run the application and check the results

# Delimiting a section of text

- Another use is to delimit only a certain section of text in which to run further PRs over
- Unlike with the Segment Processing PR, if we are dealing with multiple sections within a document, these will not be processed independently
- So co-references will still hold between different sections
- Also, those PRs which do not consider specific annotations as input (e.g. tokeniser and gazetteer), will run over the whole document regardless



# Processing a single section

Annotation Sets Annotations List Annotations Stack Class Co-reference Editor Instance Text

BBC News - Snow strands lorries on motorway

Snow strands lorries on motorway

Motorists in the Denny area were forced to dig their cars out from snow

Ten lorries were stranded for several hours as snow, rain and strong winds made driving conditions difficult across many parts of Scotland.

The lorries were travelling south on the M90, close to Bridge of Earn in Perthshire, when they became stuck in about 7.5cm (3in) of snow.

Type	Set	Start	End	Id	Features
Organization		0	8	5094	{orgType=[null], rule1=TheOrgXKey, r
title	Original markups	0	43	2	{}

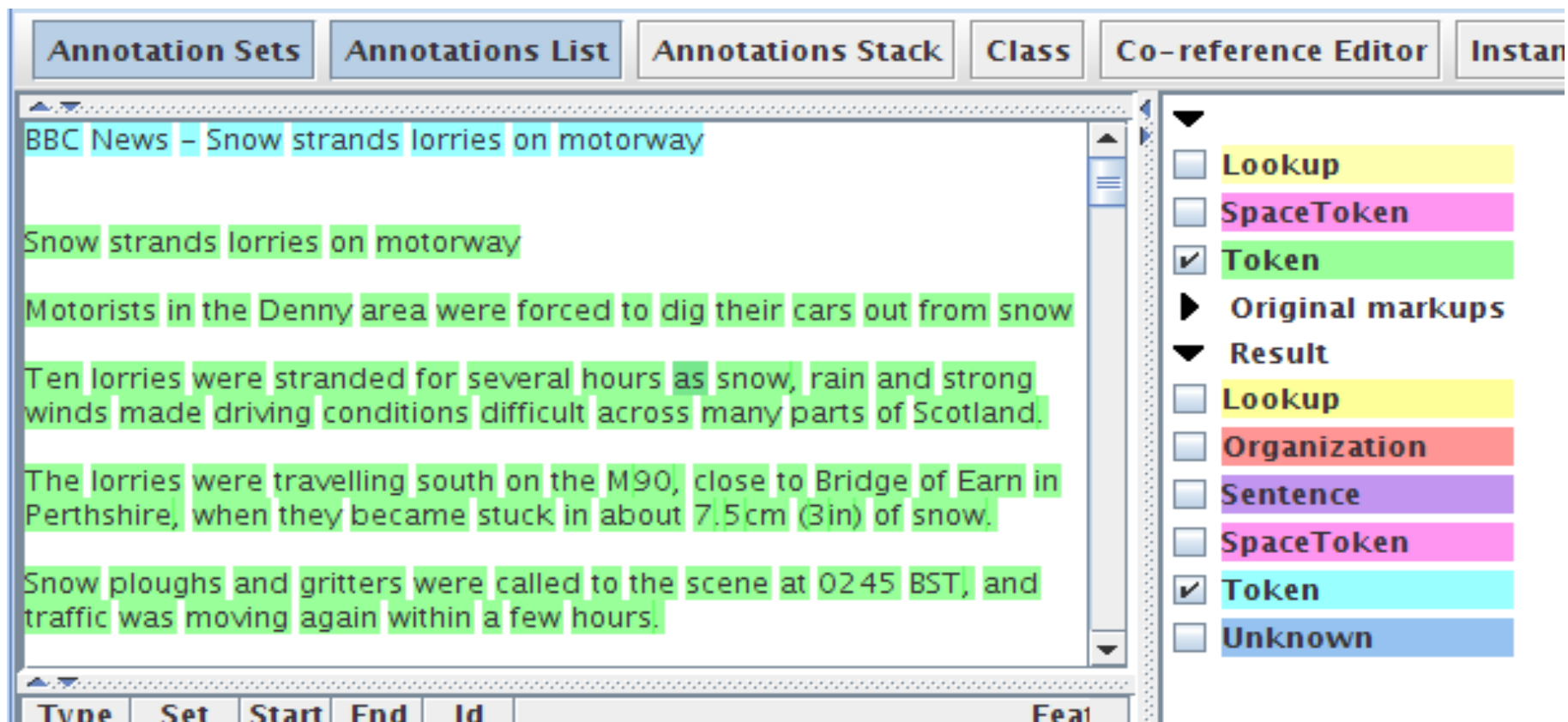
Lookup  
 Organization  
 SpaceToken  
 Token  
 Unknown  
 Original markups  
 b  
 body  
 head  
 p  
 title  
 ul

- Only the “title” section is annotated with NEs

title

# Transferring title annotations

- But the rest of the document remains tokenised
- These Tokens remain in the Default set because they weren't moved.



Annotation Sets   Annotations List   Annotations Stack   Class   Co-reference Editor   Instance

BBC News - Snow strands lorries on motorway

Snow strands lorries on motorway

Motorists in the Denny area were forced to dig their cars out from snow

Ten lorries were stranded for several hours as snow, rain and strong winds made driving conditions difficult across many parts of Scotland.

The lorries were travelling south on the M90, close to Bridge of Earn in Perthshire, when they became stuck in about 7.5cm (3in) of snow.

Snow ploughs and gritters were called to the scene at 0245 BST, and traffic was moving again within a few hours.

▼

- Lookup
- SpaceToken
- Token
- ▶ Original markups
- ▼ Result
- Lookup
- Organization
- Sentence
- SpaceToken
- Token
- Unknown

Type	Set	Start	End	Id	Feat
------	-----	-------	-----	----	------

# Setting the parameters

- Let's assume we want to process only those annotations covered by the HTML “body” annotation (i.e. we don't want to process the headers etc.).
- We'll put our final annotations in the “Result” set.
- We need to specify as parameters
  - **textTagName**: the name of the covering annotation: “body”
  - **tagASname**: the annotation set where we find this: “Original markups”
  - **annotationTypes**: which annotations we want to transfer
  - **inputASname**: which annotation set we want to transfer them from: “Default”
  - **outputASname**: which annotation set we want to transfer them into: “Result”









# Additional options



- There are two additional options you can choose
  - **copyAnnotations**: whether to copy or move the annotations (i.e. keep the originals or delete them)
  - **transferAllUnlessFound**: if the covering annotation is not found, just transfer all annotations. This is a useful option if you just want to transfer all annotations in a document without worrying about a covering annotation.

# Parameter settings

Runtime Parameters for the "Annotation Set Transfer\_00016" Annotation Set Transfer:

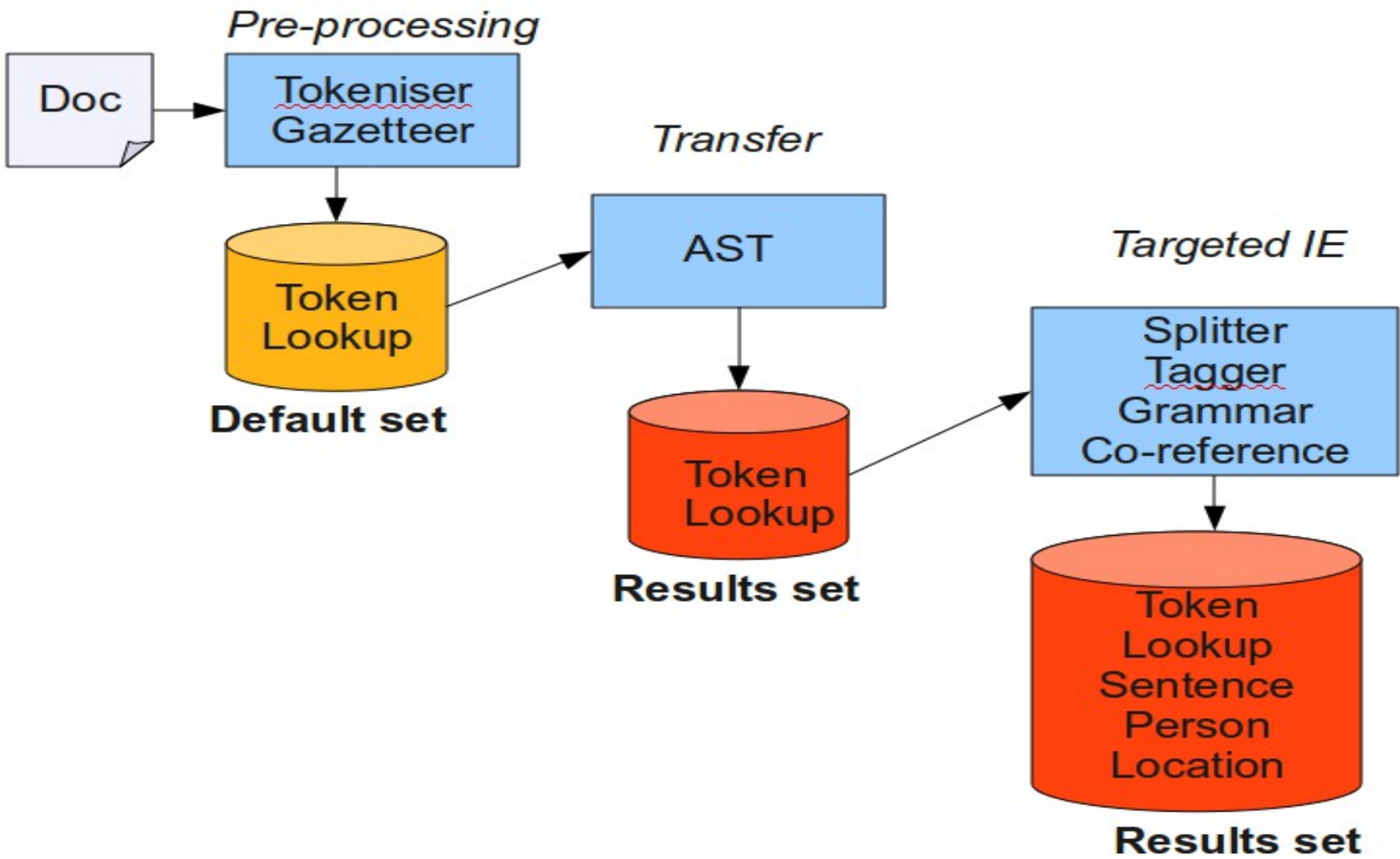
Name	Type	Required	Value
 annotationTypes	ArrayList		<input type="text" value="[]"/> 
 copyAnnotations	Boolean	✓	false
 inputASName	String		<input type="text"/>
 outputASName	String		Result
 tagASName	String		Original markups
 textTagName	String		body
 transferAllUnlessFound	Boolean	✓	false

- Move all annotations contained within the “body” annotation (found in the Original markups set), from the Default set to the Result set.
- If no “body” annotation is found, do nothing.

# Using it within an application

- We want to run ANNIE over only the text contained within the “body” text
- Apart from the tokeniser and gazetteer, the other ANNIE PRs all rely on previous annotations (Token, Lookup, Sentence, etc.)
- We run the tokeniser and gazetteer first on the whole document
- Then use the AST to transfer all relevant Token and Lookup annotations into the new set
- Then we can run the rest of the ANNIE PRs on these annotations
- To do this, we use for inputAS and outputAS the name of the new set “Result”

# Application architecture





## Hands-on: processing a document section

- Modify ANNIE to only run over the body of the document
- Load ANNIE with defaults
- Add the AST immediately after the tokeniser and gazetteer
- Set the AST parameters to move all annotations contained within the “body” annotation (found in the Original markups set), from the Default set to the Result set.
- If you get stuck, check the slide “Setting the Parameters”
- Modify the Input and Output set of all following PRs to “Result”
- Run on the corpus and inspect the results
- Now try moving the AST to immediately before the tokeniser and gazetteer - what happens when you run it?



# Content Detection using Boilerpipe



# What is the Boilerpipe PR?

- In a closed domain, you can often write some JAPE rules to separate real document content from headers, footers, menus etc.
- In many cases, or when dealing with texts of different kinds or in different formats, it can get much trickier
- Boilerpipe PR provides algorithms to separate the surplus “clutter” (boilerplate, templates) from the main textual content of a web page.
- Applies the Boilerpipe Library to a GATE document in order to annotate the content, the boilerpipe, or both.
- Due to the way in which the library works, not all features from the library are currently available through the GATE PR

# Boilerpipe Parameters

Run "Boilerpipe Content Detection\_00006"?

Yes
  No
  If value of feature  is

Corpus: <none>

Runtime Parameters for the "Boilerpipe Content Detection\_00006" Boilerpipe Content Detection:

Name	Type	Required	Value
<a href="#">?</a> allContent	Behaviour	✓	If Mime Type Is NOT Listed
<a href="#">?</a> annotateBoilerplate	Boolean	✓	false
<a href="#">?</a> annotateContent	Boolean	✓	true
<a href="#">?</a> boilerplateAnnotationName	String		Boilerplate
<a href="#">?</a> contentAnnotationName	String		Content
<a href="#">?</a> debug	Boolean	✓	false
<a href="#">?</a> extractor	Extractor	✓	Default
<a href="#">?</a> failOnMissingInputAnnotations	Boolean	✓	true
<a href="#">?</a> inputASName	String		
<a href="#">?</a> mimeTypees	Set	✓	[text/html ]
<a href="#">?</a> outputASName	String		
<a href="#">?</a> useHintsFromOriginalMarkups	Boolean	✓	true

Run this Application

# Original HTML document

Africa | Asia-Pacific | Europe | Latin America | **Middle East** | South Asia | US & Canada

8 February 2011 Last updated at 09:51



## Egypt unrest: anti-Mubarak protesters seek new resolve



Protests are continuing on Tahrir Square in central Cairo

**Protesters on Cairo's central Tahrir Square have called for a new push to oust Egyptian President Hosni Mubarak, two weeks into their campaign.**

Thousands of people still occupy the square but their lines have been gradually pushed back by the army, keen to get traffic moving again.

**Egypt Unrest**

**Egypt's competing visions**

**Interactive timeline**

### Top Stories



Government bank levies

- Assange case validity questioned
- Mubarak pushes 'transition plan'
- Helicopter bid process is halted
- Twitter posts ruled 'not private'

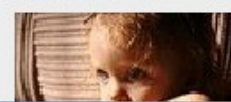
### Features & Analysis



**Closed for bus**  
John Simpson t  
at impact of pro



**They do... do**  
Could William a  
to marriage?



**Home alone**  
Is it OK for a ye

# Processed Document

Email

Print

Egypt unrest: anti-Mubarak protesters seek new resolve

Protests are continuing on Tahrir Square in central Cairo

Continue reading the main story

Egypt unrest

Egypt's competing visions

Interactive timeline

Fragile future

Q&A: Egypt protests

Protesters on Cairo's central Tahrir Square have called for a new push to oust Egyptian President Hosni Mubarak, two weeks into their campaign.

Thousands of people still occupy the square but their lines have been gradually pushed back by the army, keen to get traffic moving again.

Talks have achieved little and Mr Mubarak appears unlikely to resign.

The government has announced concessions, including a 15% pay rise for six million public sector workers.



The sidebar shows a list of processing options with checkboxes and colored backgrounds:

- Content (pink background)
- SpaceToken (green background)
- Token (yellow background)
- Original markups (black background)

Navigation arrows are visible on the left and right sides of the sidebar.





# Try it yourself

- Load the Tagger\_Boilerpipe plugin
- Create a Boilerpipe Content Detection PR
- Create a new application, and add to it a Document Reset, a Tokeniser, and the Boilerpipe PR
- Leave all the parameters as default
- Load a document from the web, e.g. one of the pages from <http://bbc.co.uk/news>, add to a corpus, and run the application
- View the “Content” annotations on the document (in the Default set)
- Change the `annotateBoilerplate` parameter from `false` to `true` and rerun the application
- View the “Boilerplate” annotations

# Schema Enforcer

- When creating an application, you often end up with lots of annotations and features which are not needed in the final output
- If pushing the output into a MIMIR index, or if storage space is an issue, it's particularly important to get rid of these
- You can tidy up the output using the AnnotationSetTransfer PR to move selected annotation types to a new set, but there's still the problem of the features
- Schema Enforcer PR will ensure that annotations and features will only appear in the final output set if they adhere strictly to the annotation schemas used
- Straightforward to use - load Schema Tools plugin and just list the schemas to be used in the runtime parameters (they must be loaded in GATE already)



# Modular Pipelines

- With a normal application (corpus pipeline) you can load other applications as sub-components, as we have seen
- The problem with this is that when you make changes to any of these sub-components and then save your main application, the original application is not saved.
- So if you want to use these sub-components separately, you have to remember to save separately any changes to them.
- The modular pipelines method gets round this by saving the individual applications separately.
- It's not part of GATE, but you can download the plugin from <https://github.com/johann-petrak/gateplugin-ModularPipelines> or from the Plugin Repository “Additional Plugins from the GATE Team”





# How to use it

- Load the Modular Pipelines plugin
- Create a new Parametrized Corpus Controller from the Applications menu
- Load an application (sub-pipeline) by creating a new Processing Resource of type “Pipeline”
- Select a .gapp file as the value of PipelineFileURL in the loadtime parameters
- This will load the application into GATE
- Add the pipeline to your Parametrized Corpus Controller application
- Add more sub-pipelines or PRs as you wish

# The Groovy PR



# Groovy Scripting PR

- Groovy is a dynamic programming language based on Java.
  - <http://groovy.codehaus.org/>
- The GATE Groovy plugin provides a powerful scripting PR that can be included in a corpus pipeline and run over each document.
- The script has full access to the current document and corpus through the GATE API, like a Java JAPE RHS but more powerful
- Unlike a JAPE Transducer, this PR does not have to match anything in the document in order to “fire the rules”

# Groovy Scripting PR

- Two init parameters:
  - **scriptURL**, the path to the script
  - **encoding** (default UTF-8)
- Once the PR is created, the path to the file cannot be changed
- Just like JAPE, you can edit the file outside of GATE, save it, and re-initialize the PR to reload the file (and get syntax error messages)
- Three runtime parameters:
  - **inputASName** and **outputASName** (annotation sets)
  - **scriptParams** (key-value pairs)

# Groovy Scripting PR

- Inside the script, you get 6 automatic variables “free of charge”:
  - **doc**, the current document (as in JAPE)
  - **corpus**, the current corpus
  - **content**, the string content of this document
  - **inputAS** and **outputAS**, the annotation sets for the current document named in the runtime parameters (as in JAPE)
  - **scriptParams**, a FeatureMap with the keys and values from the scriptParams runtime parameter, which lets you pass your own simple configuration options to the PR and change them from the pipeline interface without editing the script

# Groovy Scripting PR

- What can you do with it?
  - Anything you can do in a JAPE Java RHS, and more
  - Read/write access to the document (features, content, all annotation sets)
  - Read/write access to the corpus (features, size, contents) but be careful
  - Control structures (loops, if then else, etc.)
  - No need to match a pattern of annotations
- Example: check each document for certain things and set its features accordingly
  - features can be used to regulate conditional PRs later in a conditional corpus pipeline, for example

# Hands-on: Groovy Scripting PR

- Remove all existing documents, corpora, resources and applications from GATE
- Create a new corpus and populate it from **corpus-benchmark/test-corpus/clean** in the hands-on materials
- Load the ANNIE application and the Groovy plugin
- Create a new Groovy Scripting PR from the file **groovy/Example.groovy** in the hands-on materials, and add it to end of the ANNIE pipeline.

# Groovy Scripting PR

```
// Get all the Person annotations
AnnotationSet persons = inputAS.get("Person");

// Print the name of the current document
println(doc.getName());

// Print the text underlying each Person annotation
for (person in persons) {
    println(" " + gate.Utills.stringFor(doc, person));
}

// Record the number of Person annotations
doc.getFeatures().put("nbr_persons", persons.size());

// Flag whether the document contains any Person annotations;
// this feature can be used in a Conditional Corpus Pipeline.
doc.getFeatures().put("has_persons", ! persons.isEmpty());
```

What do you think this will do?





# Groovy Scripting PR

---

- Run the pipeline and note the output in the Messages tab.
- Open a few documents, examine the document features, and compare them with the annotations in the default AS.

# Groovy script to delimit parts of a document

```
docEnd = gate.Utills.end(doc);

// set the annotation type from an annotation in the document

interestingAnnots = inputAS.get("Interesting");

intStart = gate.Utills.start(interestingAnnots);

intEnd  = gate.Utills.end(interestingAnnots);

// add the new annotations

outputAS.add( 0L, docEnd, "WholeDoc", Factory.newFeatureMap());

outputAS.add( 0L, intStart, "BeforeInt", Factory.newFeatureMap());

outputAS.add(intStart, docEnd, "IntZone", Factory.newFeatureMap());

outputAS.add(intEnd, docEnd, "AfterInt", Factory.newFeatureMap());
```



# Try it out

- Load the JAPE grammar from the file `grammar/get-interesting.jape` and add it to the end of your ANNIE application
- You can remove or turn off the other Groovy PR if you want
- Create a new Groovy Scripting PR from the file **`groovy/Interesting.groovy`** in the hands-on materials, and add it after the new JAPE grammar you just added
- Load the document from the file `corpus/report.pdf` and add it to a new corpus
- Run the application over this corpus and check the annotations
- Bonus points: change your application so that ANNIE only runs over the `InterestingZone` part of the corpus
- More bonus points: change the groovy script to get the annotation type from the script parameters

# Putting it all together

- You can combine ideas from all these topics (and more) when creating your applications
- Here's a real example of an IE application we created for a project on business intelligence
- It involved different kinds of HTML texts, which required different processing methods
- As you will see, it's important to keep calm and do things one step at a time
- When you have complex applications like this, keeping things in separate annotation sets (and removing unwanted annotations) can help you keep track of what's going on



# Complex IE application

Pre-process all documents

Add document features depending on text type

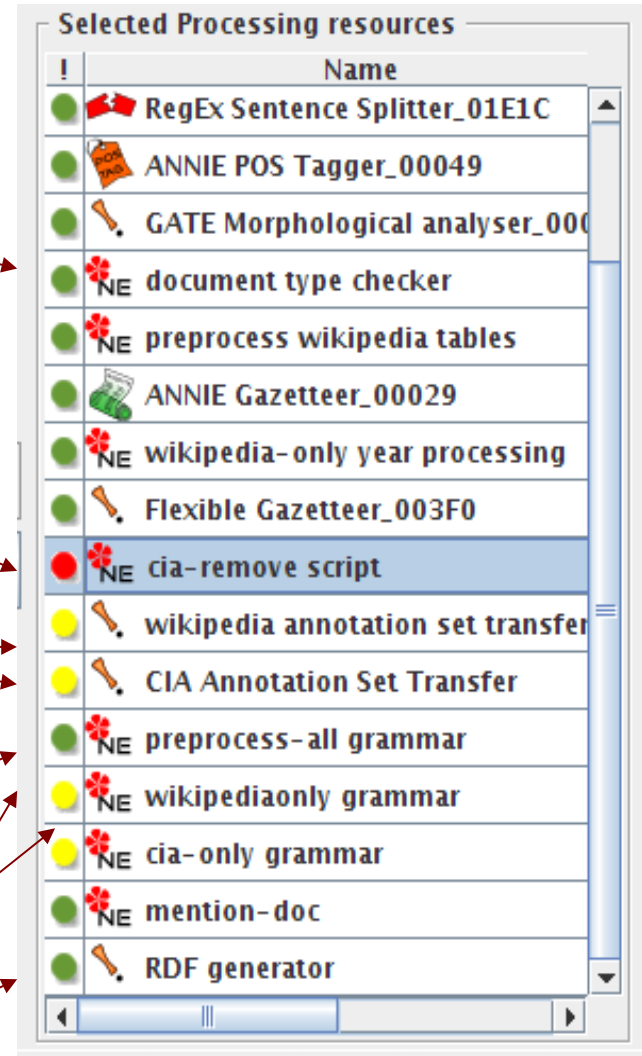
Tried this grammar out, but didn't use it ultimately

For each text type, copy the pre-processing annotations from the relevant section to a new annotation set

Pre-processing is same for all document types

Run a text-specific grammar on the documents

Do something with the results of all documents





# Summary of this module

- You should now have some ideas about how to take ANNIE a step further and do more interesting things in GATE than just IE on English news texts.
- Porting an IE system to a different language
- Processing multilingual corpora
- How to process “difficult” texts, e.g. keeping sections independent, processing only parts of a document, processing large documents.
- How to manipulate existing annotated documents
- This should enable you now to start building up more complex applications with confidence



# Take-home message for today

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- Don't be afraid to try weird and wonderful things in GATE!
- We do it all the time...sometimes it even works :-)



# Extra hands-on for the super keen

---

- Some more exercises to try out!



## Hands-on segment processing (2)

- Now we have our document separated into sections by means of the Content annotation
- Load ANNIE with defaults. Remove the Document Reset, Tokeniser and Sentence Splitter from it (make sure you remove the ones named ANNIE Tokeniser, etc. and not the ones previously loaded) and change the “failOnMissingInputAnnotations” parameter of the POS Tagger to false.
- Create a Segment Processing PR and add it to the end of your Segment application.
- Select the Segment Processing PR in the application and set the “analyser” value to “ANNIE”
- Set the value of “segmentAnnotationType” to “Content”
- Run the application and look at the results
- Look at the co-references created: they should not cross Content boundaries. Look at “Google” annotations for an example.



## Extra hands-on

- Modify ANNIE for a language of your choice, by adapting some gazetteer lists and adding some grammar rules
- If this isn't feasible for your language (e.g. Chinese) then just make an application with some simple gazetteer lists for your language and some rules which convert the Lookups into annotations
- Create a small corpus containing a combination of documents in your chosen language and in English
- Create an application that processes the documents separately but which merges the results from both into a single final annotation set
- Use any method you like to only annotate certain parts of those documents

# Extra hands-on segment processing (1)

- Clear GATE of all PRs, applications and resources
- Load the application `segment-processing.gapp`
- Load the document `execs2.html` and add it to a corpus
- Run the application on the corpus
- This application first creates an annotation type “bold” in the default annotation set, using the “b” annotations from the Original markups set.
- Have a look at the grammar `get-bold.jape` and the runtime parameters for it to see how it was done.
- Then the application uses the `get-person.jape` grammar to match a bold annotation followed by a set of sentences, creating a new annotation “Content” in the default annotation set.
- Have a look at the “bold” and “Content” annotations in the document.

## Hands-on segment processing (2)

- Now we have our document separated into sections by means of the Content annotation
- Load ANNIE with defaults. Remove the Document Reset, Tokeniser and Sentence Splitter from it (make sure you remove the ones named ANNIE Tokeniser, etc. and not the ones previously loaded) and change the “failOnMissingInputAnnotations” parameter of the POS Tagger to false.
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