Overview of CLIR Task at the Fifth NTCIR Workshop

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Abstract

The purpose of this paper is to overview research efforts at the NTCIR-5 CLIR task, which is a project of large-scale retrieval experiments on cross-lingual information retrieval (CLIR) of Chinese, Japanese, Korean, and English. The project has three sub-tasks, multi-lingual IR (MLIR), bilingual IR (BLIR), and single language IR (SLIR), in which many research groups from over ten countries are participating. This paper describes the system of the NTCIR-5 CLIR task and its test collection (document sets, topic sets, and method for relevance judgments), and reviews CLIR techniques used by participants and search performance of runs submitted for evaluation.

Keywords: *Cross-lingual information retrieval; Evaluation; Retrieval experiment*

1 Introduction

In the previous NTCIR-4 workshop, 26 research groups participated in the CLIR (cross-lingual information retrieval) task, and useful findings for developing CLIR techniques on East-Asian languages (i.e., Chinese, Japanese and Korean) and English were reported [8]. The CLIR task is again organized in the NTCIR-5 project for promoting CLIR researches furthermore.

The task design is almost same as that in the previous NTCIR-4 workshop, i.e., we have three subtasks:

- *Multilingual CLIR* (MLIR),
- *Bilingual CLIR* (BLIR), and
- *Single Language IR* (SLIR).

However, the document collection for evaluation was changed to a set of more current news articles published in 2000 and 2001.

This paper aims at reporting on the CLIR task in the NTCIR-5 workshop. In the section 2, the design of the task is explained. The section 3 discusses the document collection and search topics. The outline of submission of results is described in the section 4, and the section 5 dedicates to an explanation of relevance judgments. The section 6 reviews retrieval techniques used by participating research groups. Finally, search performance by subtasks is discussed in the section 7.

2 Design of the CLIR Task

2.1 Schedule

The Call for Participant (CFP) was first released on Aug. 2004. The time schedule for the NTCIR-5 CLIR task is as follows.

2004-09-30: Application Due
2004-11-20: Document sets (CJK) Release
2005-05-01: Distribution of Search Topics
2005-06-01: Submission of Search Results (CJK)
2005-07-07: Document sets (English) Release
2005-08-15: Submission of Search Results (English)
2005-09-13: Delivery of Evaluation Results (CJK)
2005-10-02: Delivery of Evaluation Results (English)
2005-10-15: Paper Due (for Proceedings)
2005-12: NTCIR Workshop 5 (Conference)

2.2 Subtasks

2.2.1 Multilingual CLIR (MLIR). In general, the document set of MLIR subtask consists of two or more languages. For the NTCIR-5 CLIR task, the multilingual search is limited to use the CJKE collection, which consists of Chinese(C), Japanese(J), Korean(K) and English(E) documents. Regarding the topic set, participants can select one language from CJKE for each run. Therefore, there are four combinations of topic sets and the document set, i.e.,

Topic set: C or J or K or E >> Doc set: CJKE

2.2.2 Bilingual CLIR (BLIR). BLIR means that the document set in a single language is searched for a topic in a different language, e.g., searching Japanese documents for Korean topics (K-J run). In the NTCIR-5 CLIR task, participants are basically not allowed to submit results of runs using topics written in English, except the case of trying pivot language approach. The combinations of topics and documents for the BLIR subtask are as follows:

Topic set: C >> Doc set: J or K or E
Topic set: J >> Doc set: C or K or E
Topic set: K >> Doc set: C or J or E

Topic set: E >> Doc set: C or J or K
(in the case of pivot language approach)

2.2.3 Single language IR (SLIR). The topic set and document sets of SLIR are written in a same language. The combinations of topics and documents for the SLIR subtask are as follows:

Topic set: C >> Doc set: C
Topic set: J >> Doc set: J
Topic set: K >> Doc set: K
Topic set: E >> Doc set: E

2.3 Topic fields and run types

2.3.1 Types of runs. Basically, each topic consists of four fields, i.e., “T” (TITLE), “D” (DESC), “N” (NARR) and “C” (CONC) (see below for details). We can categorize search runs based on the fields used for execution. In the NTCIR-5 CLIR task, the following types of runs are adopted:

- *Mandatory runs*: T-run and D-run
  Each participant must submit two types of run for each combination of topic language and document language(s);
  T-run, for which only TITLE field is used,
  D-run, for which only DESC field is used
  The purpose of asking participants to submit these mandatory runs is to make research findings clear by comparing systems or methods under a unified condition.
- *Recommended runs*: DN-run
  Participants are also recommended to execute DN run that employs both <DESC> and <NARR> fields.
- *Optional runs*
  Other any combinations of fields are allowed to submit as optional runs according to each participant’s research interests, e.g., TDN-run, DC-run, TDNC-run and so on.

2.3.2 Number of runs. Each participant can submit up to 5 runs in total for each language pair regardless of the type of run, and participants are allowed to include two T runs in maximum and also two D-runs in maximum into the 5 runs. The language pair means the combination of topic language and document language(s). For example,

Language combination -> Topic: C and Docs: CJKE (C->CJKE)
Submission -> two T-runs, a D-run, a DN-run and a TDNC run (5 runs in total).

2.3.3 Identification and priority of runs. Each run has to be associated with a RunID. RunID is an identity for each run. The rule of format for RunID is as follows.

Group's ID - Topic Language - Document Language - Run Type - pp

The 'pp' is two digits used to represent the priority of the run. It is used as a parameter for pooling. The participants have to decide the priority for each submitted run among them on each language pair. The "01" means the highest priority. For example, a participating group, LIPS, submits 3 runs for C-CJKE. The first is a T run, the second is a D run and the third is a DN run. Therefore, the Run ID for each run is LIPS-C-CJKE-T-01, LIPS-C-CJKE-D-02, and LIPS-C-CJKE-DN-03, respectively.

3 Test Collection

3.1 Document Sets

The documents used at the NTCIR-5 CLIR task are news articles collected from various news agencies from different countries. Table 1 shows the sources and the numbers of records in the document collections. The tags used for separating each field in a record are also indicated in Table 2.

Table 1 Document sets for the NTCIR-5 CLIR task

Sources		No. of Docs
Chinese 2000-01		
	CIRB040r (United Daily News (udn), United Express (ude), Ming Hseng News (mhn), Economic Daily News (edn))	901,446
	Total	**901,446**
Japanese 2000-01		
	Mainichi	199,681
	Yomiuri	658,719
	Total	**858,400**
Korean 2000-01		
	Hankookilbo	85,250
	Chosunilbo	135,124
	Total	**220,374**
English 2000-01		
	Mainichi Daily News (Japan)	12,155
	Korea Times	30,530
	Xinhua (AQUAINT)	198,624
	Daily Yomiuri (Japan)	17,741
	Total	**259,050**

3.2 Topic

Each topic has four fields; 'T' (TITLE), 'D' (DESC), 'N' (NARR), 'C' (CONC). The following shows a sample topic.

<TOPIC>
<NUM>009</NUM>
<SLANG>CH</SLANG>
<TLANG>EN</TLANG>
<TITLE>Japan, South Korea, Fishery Agreement</TITLE>
<DESC>Find articles on the content of the final fishery agreement between Japan and South Korea</DESC>
<NARR>
<BACK>There are frequent disputes between Japan and South Korea because of the 35 years of colonized reign. Things worsened in January of 1998 when Japan announced the abolishment of the fishery agreement of 1965. Finally, in September of 1998, a new fishery agreement between Japan and South Korea was reached despite disputes over the sovereignty of the isles. It marked an end to eight months of serious disputes between the two countries. Please query the content of this new agreement for things such as allocation of fishing areas and results of negotiation.</BACK>
<REL>Documents of reports on the final fishery agreement are relevant. Reports on historical disputes and events between Japan and South Korea are not relevant.</REL>
</NARR>
<CONC>Japan, South Korea, Fishery Agreement, Isles, Fishing Area</CONC>
</TOPIC>

Table 2 Tags used for identifying each filed

Mandatory tags	
<DOC>	The tag for each document
<DOCNO>	Document identifier
<LANG>	Language code: CH, EN, JA, KR
<HEADLINE>	Title of this news article
<DATE>	Issue date
<TEXT>	Text of news article
Optional tags	
<P>	Paragraph marker
<SECTION>	Section identifier in original newspapers
<AE>	Contain figures or not
<WORDS>	Number of words in 2 bytes (for Mainichi Newspaper)

The tags used in topics are shown in Table 3. The topics were created in Taiwan, Japan and Korea, separately (see also Table 4), and finally 50 topics were selected based on results of feasibility test checking the numbers of relevant documents in each document set. The original language used in the process of creating topics is recorded in the <SLANG> field.

Subsequently, selected 50 topics were translated into English, and each English topic was translated into each Asian language except the original language. All translation works were done by human translators. Through the process, four languages (CJKE) versions

of all 50 topics were prepared.

Table 3 Topic tags used in the NTCIR-5 CLIR task

<TOPIC>	The tag for each topic
<NUM>	Topic identifier
<SLANG>	Source language code: CH, EN, JA, KR
<TLANG>	Target language code: CH, EN, JA, KR
<TITLE>	The concise representation of information request, which is composed of noun or noun phrase.
<DESC>	A short description of the topic. The brief description of information need, which is composed of one sentence.
<NARR>	A much longer description of topic. The <NARR> may has three parts; (1)<BACK>...</BACK>: background information about the topic is described. (2)<REL>...</REL>: further interpretation of the request and proper nouns, the list of relevant or irrelevant items, the specific requirements or limitations of relevant documents, and so on are given. (3)<TERM>...</TERM>: definition or explanation of proper nouns, scientific terms and so on.
<CONC>	The keywords relevant to the whole topic.

Table 4 Distribution of topics by source

Source	# of topics	Topic ID
Taiwan	18	No.001 - 018
Korea	18	No.019 - 036
Japan	14	No.037 - 050
Total	50	

4 Submission of Results

In total, search results were submitted by 24 groups from 13 countries and regions (see Table 5). Regarding the numbers of participants, Japan is dominant (6 groups), followed by USA (4 groups). Appendix 1 shows the names of groups submitting the search results.

Unfortunately, other 7 groups that applied to participate in the NTCIR-5 CLIR task could not submit final results for some reasons.

Table 6 shows the number of submitted runs and groups. In total, 379 runs were submitted, of which 201 (53.0%) are for SLIR, 153 (40.4%) BLIR, and 25 (6.6%) MLIR.

Table 5 Regional Distribution of Participants

	# of groups*
Australia	2
Canada	1
China	2
(Hong Kong)	1
Finland	1
Japan	6*
Korea	1
Netherlands	1
Singapore	1
Spain	1
Switzerland	1
Taiwan	2
USA	4
Total	24

* includes one collaborative group of Japanese and German institutes.

Table 6 Statistics on submissions for the NTCIR-5 CLIR task

	Run types	# of runs	# of groups
SLIR	C-C	65	15
	J-J	69	15
	K-K	39	9
	E-E	28	7
	Total	201	-
BLIR	C-J	21	4
	C-K	10	2
	C-E	20	5
	J-C	10	2
	J-K	10	2
	J-E	14	3
	K-C	5	1
	K-J	16	3
	K-E	5	1
	E-C	12	3
	E-J	21	5
	E-K	9	2
	Total	153	-
MLIR	C-CJKE	5	1
	J-CJKE	5	1
	K-CJKE	5	1
	E-CJKE	10	2
	Total	25	-
Total		379	24

5 Results of Relevance Judgments

5.1 Procedure of relevance judgments

Evaluation in the NTCIR-5 CLIR task is based on the TREC-like procedures using results of relevance of each pool of retrieved documents for topics (Appen-

dix 2 shows the size of each pool for identifying relevant documents). The trec_eval program was used to score search results submitted by participants.

In order to keep measurement granularity, we assigned four degrees to each document in the process of relevance judgments; "S: highly relevant", "A: relevant", "B: partially relevant", and "C: irrelevant". Like the previous workshops, two kinds of relevance degree,

- *Rigid relevance*: S+A,
- *Relaxed relevance*: S+A+B,

are used for evaluating search results, since trec_eval scoring program adopts binary relevance. Hence, two files of relevance judgments (rigid and relaxed) for each collection (C, J, K and CJKE) are prepared by the task organizers.

5.2 Relevant documents and effective sets of topics for evaluation

Appendix 3 indicates the numbers of relevant documents included in the document sets. There are some topics for which relevant documents are very few. Therefore, like the previous workshop, the task organizers applied the "3-in-S+A" criterion, which means that only topics having three or more "rigid" relevant documents are used for evaluation.

According to the criterion, the sets of topics for each document collection are as follows:

(1) Chinese collection: all 50 topics are used.
(2) Japanese collection: 47 topics are used (the topics 021, 023 and 039 are removed).
(3) Korean collection: all 50 topics are used.
(4) English collection: 49 topics are used (the topic 026 is removed)
(5) CJKE multilingual collection: all 50 topics are used.

6 Overview of CLIR Techniques

In CLIR research field, various techniques have been proposed for enhancing the search performance [9]. This section dedicates to review techniques or methods used in the NTCIR-5 CLIR task.

6.1 Indexing methods

6.1.1 Indexing of CJK text. Like the previous workshop, two methods

- Overlapping bi-gram
- Word-based indexing

are widely used for indexing text of CJK languages. HKPU[24] and NIIHI[10] have tried to combine the results from these two methods. Comparison of search performance between the two indexing methods is explored by UniNE[1]. Also, unigram is applied in ILPS[7] and dictionary-based segmentation techniques are used by KLE[18], UNTIR[2] and so on. In particular, KLE[18] explored a collection-based segmentation method for Korean text, in which a statistically dictionary is created according to collection statistics on term occurrence.

As other indexing techniques, CCNU[6] applied a cluster-based term extraction method to indexing of Chinese text, and NIIHI[10] attempted a pronunciation-based indexing for Japanese text by using output from ChaSen that is a well-known morphological tool.

6.1.2 Decompounding. HUM[21] reports impact of decompounding CJK multi-words terms. Also, in NICT[17], automatically combining components in Japanese compound words was attempted.

6.1.3 Identifying named entities. PIRCS[11] applied BBN's IdentiFinder for detecting entities included in the query text.

6.1.4 Dictionaries for indexing. UNTIR[2] attempted to make an extended segmentation dictionary by combining information from various resources.

6.2 Translation

6.2.1 Translation methods. Almost of groups participating in BLIR and MLIR tasks adopt the query translation method using machine translation (MT) systems or machine readable dictionaries (MRDs). PIRCS[11] compared performance between MT and MRD in E-K bilingual searches. Only OKI[19] investigated the effect of document translation using a MT system.

6.2.2 Term disambiguation. For disambiguating translations, RMIT[25] applied a method based on co-occurrence statistics in the target document collection and external Web resources, in which hidden Markov model (HMM) is used. Also, TSB[20] used a partial disambiguation method, in which alternative translations remain after a semantic analysis and are treated as a set of synonyms. PIRCS[11] attempted to disambiguating translation by using term occurrence statistics in the target collection. In ISCAS[15], a disambiguation technique using a Web search engine was applied.

6.2.3 Out-of-vocabulary problem. ISCAS[15] explored a Web-based method for solving the out-of-vocabulary (OOV) problem. RMIT[25] also developed an OOV translation extraction algorithm based on co-occurrence statistics.

6.2.4 Transliteration. Transliteration of Japanese Katakana words was used by tlrrd[16].

6.2.5 Conversion of *Kanji* codes. BRKLY[5] applied a method of converting codes of *Kanji* characters for executing bilingual searches between Japanese and Chinese.

6.2.6 Pivot language approach. Some groups used pivot language approach, in which the query is translated via an intermediary language (e.g., English) as follows.

- C-E-J (MIRAa[23], BRKLY[5])
- C-E-K (PIRCS[11])
- C-J-E-K (OKI[19]) : two pivot languages were used.
- C-J-E (TSB[20])
- J-E-C (BRKLY[5])
- J-E-K (OKI[19])
- K-E-J (MIRAa[23])

6.3 Retrieval model

As usual, OKAPI (BM25 and its variations), vector model (SMART), logistic regression model, language mode (LM) and so on were used for scoring each document. UniNE[1] attempted comparing performance between some retrieval models. ILPS[7] explored effective combinations of retrieval models (vector or LM) and indexing units (bi-gram or uni-gram) in Chinese retrieval. Also, in UniNE[1], some variations of data fusion techniques (e.g., Z-score) were examined empirically.

6.4 Query expansion and re-ranking

6.4.1 Pseudo-relevance feedback. For enhancing search performance, most of groups were using pseudo-relevance feedback (RPF) techniques based on the probabilistic, Ponte or Rocchio methods. In YLMS[4], the performance of PRF in various test collections was intensively discussed. NICT[17] explored a technique that assigns greater weight to terms included in higher ranked documents in PRF.

In general, the PRF improves search effectiveness averagely, but sometimes deteriorates performance for a particular topic. For solving the problem, trrld[16] developed a prediction rule for determining whether PRF is applied or not. PIRCS[11] also applied a filtering rule for selecting topics to be automatically augmented by their own Web-based expansion (see below).

6.4.2 Web-based expansion. Some groups tried to use Web documents as an external resource for query expansion. PIRCS[11] extracted new terms based on occurrence frequencies from a set of Web pages that a search engine provided. CCNU[6] tried to expand the queries by using a related term list constructed automatically from Web news sites based on the hierarchal clustering.

6.4.3 Statistical thesauri. For query expansion, FJUIR[22] used a statistical thesaurus constructed automatically from the NTCIR-4 Chinese document collection based on term co-occurrence. Also, the list of related terms that CCNU[6] compiled automatically from Web resources can be considered as a kind of statistical thesaurus.

6.4.4 "*Bounce-and-Throw*" technique. TSB[20] tried to extract another set of query terms from top-ranked documents obtained by searching an external document collection for the original query. The technique was called "*Bounce-and-Throw*", in which finally the set of terms is used for searching the target collection and its result is merged with that by original query terms (i.e., it is a kind of data fusion).

6.4.5 Pre-translation expansion. In PIRCS[11], web-based query expansion, as described above, was used for pre-translation expansion in E-C bilingual searches.

6.4.6 Document re-ranking. I2R[12] tried to apply a document re-ranking approach, in which new weights of the query terms are computed in top-ranked 1000 documents by considering relative term frequency, term length and document ranking position, and document scores are calculated again according to the new weights. Also, HKPU[24] used the "*title re-ranking method*", in which documents are re-ranked based on a matching score between titles of the query and of the document. RYU[14] proposed a new two-stage searching whose second stage uses Kohonen's SOM (self-organizing map).

6.5 Others

In qut[13], XML document search engine was applied to standard document retrieval. UNTIR[2] analyzed topics of the NTCIR-5 CLIR task according to the query categorization schema by Chen[3].

7 Search Results and Performance

In this section, we shall discuss effectiveness or search runs submitted by participants. Recall-precision curves of top-ranked groups (at most, up to eight groups) are shown in Appendix. Note that search runs that were submitted after the deadline are marked with an asterisk "*" in this section.

7.1 SLIR runs

7.1.1 C-C runs. In total, 65 Chinese monolingual runs (C-C runs) were submitted by 25 groups (see Table 6). Table 7 shows average, median, maximum

and minimum values of mean average precision (MAP) by types of runs. We use the following notations;
C-C: all C-C monolingual runs
C-C-T: all C-C <TITLE>-only runs (T-runs)
C-C-D: all C-C <DESC>-only runs (D-runs)
C-C-O: all runs other than T- and D-runs.
Note that these notations will be used for other languages (J, K, and E).

Table 8 indicates top eight runs ranked according to MAP scores of D-runs based on rigid relevance. I2R-C-C-D-01 shows the best performance, for which the document re-ranking method and query expansion are used.

Table 7 MAP of overall C-C runs

(a) Average and median

	Average		Median	
	Rigid	Relax	Rigid	Relax
C-C	0.3090	0.3613	0.3224	0.3825
C-C-T	0.2874	0.3319	0.3069	0.3576
C-C-D	0.2986	0.3523	0.3223	0.3839
C-C-O	0.3520	0.4131	0.3772	0.4399

(b)Min and max

	Min		Max	
	Rigid	Relax	Rigid	Relax
C-C	0.0061	0.0112	0.5047	0.5441
C-C-T	0.0086	0.0112	0.5047	0.5441
C-C-D	0.0061	0.0113	0.4826	0.5249
C-C-O	0.1876	0.2175	0.4419	0.5095

Table 8 Top-ranked 8 groups (C-C, Rigid, D-runs)

Run-ID	MAP
I2R-C-C-D-01	0.4826
UniNE-C-C-D-05	0.4002
ISCAS-C-C-D-01	0.3963
pircs-C-C-D-02	0.3897
CCNU-C-C-D-02	0.3441
OKI-C-C-D-04	0.3330
HKPU-C-C-D-01	0.3330
UNTIR-C-C-D-03	0.3279

7.1.2 J-J runs. In total, 69 J-J monolingual runs were submitted by 15 groups (see Table 6). Table 9 shows average, median, maximum and minimum values of MAP by types of runs. Table 10 indicates top eight groups ranked according to MAP scores of D-runs based on rigid relevance.

7.1.3 K-K runs. In total, 39 K-K monolingual runs were submitted by 9 groups (see Table 6). Table 11 shows average, median, maximum and minimum values of MAP by types of runs. Table 12 indicates top eight groups ranked according to MAP scores of D-runs based on rigid relevance.

Table 9 MAP of overall J-J runs

(a) Average and median

	Average		Median	
	Rigid	Relax	Rigid	Relax
J-J	0.2991	0.3856	0.3122	0.4056
J-J-T	0.2954	0.3795	0.3246	0.4144
J-J-D	0.2861	0.3741	0.3018	0.4008
J-J-O	0.3150	0.4021	0.3350	0.4400

(b)Min and max

	Min		Max	
	Rigid	Relax	Rigid	Relax
J-J	0.1164	0.1591	0.4480	0.5427
J-J-T	0.1344	0.1697	0.4193	0.5028
J-J-D	0.1195	0.1591	0.3823	0.4707
J-J-O	0.1164	0.1625	0.4480	0.5427

Table 10 Top-ranked 10 groups (J-J, Rigid, D-runs)

Run-ID	MAP
UniNE-J-J-D-03	0.3823
YLMS-J-J-D-04*	0.3674
TSB-J-J-D-04	0.3526
KLE-J-J-D-02	0.3262
BRKLY-J-J-D-03	0.3212
NICT-J-J-D-02	0.3162
pircs-J-J-D-02	0.3018
HUM-J-J-D-05	0.3008

Table 11 MAP of overall K-K runs

(a) Average and median

	Average		Median	
	Rigid	Relax	Rigid	Relax
K-K	0.3959	0.4419	0.4468	0.4926
K-K-T	0.3846	0.4259	0.4335	0.4565
K-K-D	0.4017	0.4507	0.4541	0.5131
K-K-O	0.4014	0.4488	0.4634	0.5217

(b)Min and max

	Min		Max	
	Rigid	Relax	Rigid	Relax
K-K	0.1076	0.1209	0.5586	0.6159
K-K-T	0.1429	0.1666	0.4912	0.5441
K-K-D	0.1076	0.1209	0.5079	0.568
K-K-O	0.1843	0.2049	0.5586	0.6159

7.1.4 E-E runs. In total, 28 E-E monolingual runs were submitted by 7 groups (see Table 6). Table 13 shows average, median, maximum and minimum values of MAP by types of runs. Table 14 indicates top seven groups ranked according to MAP scores of D-runs based on rigid relevance.

Table 12 Top-ranked 8 groups (K-K, Rigid, D-runs)

Run-ID	MAP
KLE-K-K-D-02	0.5079
NICT-K-K-D-05	0.4936
UniNE-K-K-D-03	0.4845
pircs-K-K-D-02	0.4816
OKI-K-K-D-04	0.4334
HUM-K-K-D-05	0.4160
FJUIR-K-K-D-03	0.3106
tlrrd-K-K-D-01	0.2985

Table 13 MAP of overall E-E runs

(a) Average and median

	Average		Median	
	Rigid	Relax	Rigid	Relax
E-E	0.4002	0.4501	0.4253	0.476
E-E-T	0.3854	0.4423	0.4133	0.4774
E-E-D	0.3957	0.4361	0.4241	0.4587
E-E-O	0.4283	0.4832	0.4592	0.5235

(b)Min and max

	Min		Max	
	Rigid	Relax	Rigid	Relax
E-E	0.1984	0.2280	0.5019	0.5464
E-E-T	0.1984	0.2280	0.4539	0.5046
E-E-D	0.2453	0.2909	0.4581	0.4981
E-E-O	0.2215	0.2477	0.5019	0.5464

Table 14 Top-ranked 7 groups (E-E, Rigid, D-runs)

Run-ID	MAP
UniNE-E-E-D-03	0.4581
OKI-E-E-D-04	0.4350
NICT-E-E-D-05	0.4314
pircs-E-E-D-04	0.4241
TSB-E-E-D-04	0.4198
QUT-E-E-D-01	0.2659
WMMKS-E-E-D-02	0.2453

7.2 BLIR

7.2.1 BLIR runs on Chinese document sets. In total, 10 J-C runs were submitted by 2 groups, 5 K-C runs by a group, and 12 E-C runs by 3 groups (see Table 6). BRKLY-J-C-D-04 is based on pivot language approach via English, in which queries were translated by MT system. pircs-E-C-D-03 uses an MT system with Web-based expansion.

7.2.2 BLIR runs on Japanese document sets. In total, 21 C-J runs were submitted by 4 groups, 16 K-J runs by 3 groups, and 21 E-J runs by 5 groups (see Table 6). TSB-C-J-D-03 uses an MT system and TSB-E-J-D-04 is based on MT with partial disambiguation. In contrast, KLE-K-J-D-04 was executed by dictionary-based query translation.

Table 15 Best runs of each group (J-C, Rigid, D-runs)

Run-ID	MAP
BRKLY-J-C-D-04	0.1568
OKI-J-C-D-04	0.0779

Table 16 Best runs of each group (K-C, Rigid, D-runs)

Run-ID	MAP
OKI-K-C-D-04	0.0377

Table 17 Best runs of each group (E-C, Rigid, D-runs)

Run-ID	MAP
pircs-E-C-D-03	0.2682
OKI-E-C-D-04	0.0853
ISCAS-E-C-D-01	0.0786

Table 18 Best runs of each group (C-J, Rigid, D-runs)

Run-ID	MAP
TSB-C-J-D-03	0.2471
OKI-C-J-D-04	0.1932
BRKLY-C-J-D-04	0.1639
MIRAa-C-J-D-04*	0.1388

Table 19 Best runs of each group (K-J, Rigid, D-runs)

Run-ID	MAP
KLE-K-J-D-04	0.2799
MIRAa-K-J-D-04*	0.1724
OKI-K-J-D-04	0.0583

Table 20 Best runs of each group (E-J, Rigid, D-runs)

Run-ID	MAP
TSB-E-J-D-04	0.2981
NICT-E-J-D-02	0.2663
OKI-E-J-D-04	0.1986
MIRAa-E-J-D-04*	0.1728
tlrrd-E-J-D-02	0.0784

7.2.3 BLIR runs on Korean document sets. In total, 10 C-K runs were submitted by 2 groups, 10 J-K runs by 2 groups, and 9 E-K runs by 2 groups (see Table 6). pircs-C-K-D-05 is based on pivot language approach via English, in which CE was executed with pre-translation expansion using Web resources. KLE-J-K-D-04 is based on dictionary-based query translation and pircs-E-K-D-03 was executed by MT and Web translation.

Table 21 Best runs of each group (C-K, Rigid, D-runs)

Run-ID	MAP
pircs-C-K-D-05	0.3263
OKI-C-K-D-04	0.1406

Table 22 Best runs of each group (J-K, Rigid, D-runs)

Run-ID	MAP
KLE-J-K-D-04	0.4511
OKI-J-K-D-04	0.1612

Table 23 Best runs of each group (E-K, Rigid, D-runs)

Run-ID	MAP
pircs-E-K-D-03	0.4092
OKI-E-K-D-04	0.1171

7.2.4 BLIR runs on English document sets. In total, 20 C-E runs were submitted by 5 groups, 14 J-E runs by 3 groups, and 5 K-E runs by a group (see Table 6). RMIT-C-E-D-04 was executed by dictionary-based query translation with Web-based disambiguation. TSB-J-E-D-04 is based on MT with partial disambiguation.

Table 24 Best runs of each group (C-E, Rigid, D-runs)

Run-ID	MAP
RMIT-C-E-D-04	0.4042
pircs-C-E-D-01	0.3556
TSB-C-E-D-04	0.3411
OKI-C-E-D-04	0.2356
WMMKS-C-E-D-02	0.1521

Table 25 Best runs of each group (J-E, Rigid, D-runs)

Run-ID	MAP
TSB-J-E-D-04	0.4135
NICT-J-E-D-05	0.3967
OKI-J-E-D-02	0.3365

Table 26 Best runs of each group (K-E, Rigid, D-runs)

Run-ID	MAP
OKI-K-E-D-04	0.1003

7.2.5 Summary on BLIR. Table 27 shows best runs of BLIR with best SLIR (monolingual) runs. J-E, J-K and C-E searches show very high performance in comparison with SLIR runs (90.3%, 88.8% and 88.2%, respectively). Also, E-K, E-J, K-J, C-K and C-J keep moderately high performance (over 60%). In contrast, there is a room for further research efforts on other combinations of languages.

Table 27 Summary on BLIR: Best runs (Rigid, D-runs)

	Documents			
	C	J	K	E
Mono. (base)	.4826 (100%)	.3823 (100%)	.5079 (100%)	.4581 (100%)
C→X	—	.2471 (64.6%)	.3263 (64.2%)	.4042 (88.2%)
J→X	.1568 (32.5%)	—	.4511 (88.8%)	.4135 (90.3%)
K→X	.0377 (7.8%)	.2799 (73.2%)	—	.1003 (21.9%)
E→X	.2682 (55.6%)	.2981 (78.0%)	.4092 (80.6%)	—

7.3 MLIR

In the case of MLIR, only two groups submitted search results whose performance is shown in Table 8.

Table 28 Best runs of each group by run type (MLIR, Rigid, D-runs)

Run-ID	MAP
OKI-C-CJKE-DN-03	0.2052
OKI-J-CJKE-DN-03	0.1890
OKI-K-CJKE-TDNC-01	0.1347
UniNE-E-CJKE-DN-01	0.2695
OKI-E-CJKE-DN-03	0.2110

8 Concluding remarks

For particular combinations of languages, the performance of BLIR was very high. This may be due to improvement of language resources (MT system, dictionaries and so on) and enhancement of techniques (PRF, disambiguation and so on). In contrast, we have not yet reached a sufficient level of performance in some combinations of languages. Of course, we need to attempt improving effectiveness of monolingual searches furthermore. In this workshop, it seems that query expansion or document re-ranking were extensively explored by some research groups. More research efforts will be needed for enhancing monolingual and bilingual (cross-lingual) retrieval.

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Appendix 1. List of Participating Groups

	ID	Name of Group	Country
1	BRKLY	Berkeley Text Retrieval Research Group	USA
2	CCNU	Central China Normal University	China
3	FJUIR	Information Retrieval Laboratory; Fu Jen Catholic University	Taiwan
4	HKI	University of Helsinki	Finland
5	HKPU	The Hong Kong Polytechnic University	Hong Kong
6	HUM	Hummingbird	Canada
7	I2R	Institute for Infocomm Research	Singapore
8	ILPS	University of Amsterdam	Netherlands
9	ISCAS	Institute of Software; Chinese Academy of Sciences	China
10	KLE	KLE Lab. Pohang University of Science and Engineering	Korea
11	MIRAa	MIRACLE	Spain
12	NICT	National Institute of Information and Communications Technology	Japan
13	NIIHI	NII - University of Hildesheim	Japan / Germany
14	OKI	Oki Electric Industry	Japan
15	PIRCS	Computer Science Dept.; Queens College; CUNY	USA
16	qut	Distributed IR Group; QUT	Australia
17	RMIT	RMIT Computer Science & IT	Australia
18	RYU	Ryukoku University / National Institute of Information and Communications Technology	Japan
19	tlrrd	TLR Research & Development Group	USA
20	TSB	Toshiba Corporate R&D Center	Japan
21	UniNE	University of Neuchatel	Switzerland
22	UNTIR	University of North Texas	USA
23	WMMKS	Web Mining and Multilingual Knowledge System Laboratory;National Cheng Kung University	Taiwan
24	YLMS	Yahoo	Japan

Appendix 2. Pool size and the numbers of documents judged by each language

topic	CH		JA		KR		EN	
	size	#doc	size	#doc	size	#doc	size	#doc
001	100	1631	100	1316	100	873	100	620
002	100	1665	100	1497	100	691	100	852
003	100	1017	100	1476	100	1795	100	1218
004	100	1920	100	2098	100	1869	100	1800
005	100	2222	100	2365	100	1507	100	1542
006	100	1710	100	976	100	423	100	634
007	100	1667	70	2182	100	2127	100	253
008	100	1303	100	1665	100	777	100	702
009	70	2109	100	2324	100	1486	100	1444
010	100	1272	100	1842	100	1128	100	1324
011	100	2428	100	2572	100	1261	100	1621
012	100	2362	100	1921	100	1128	100	1663
013	100	1917	100	2005	100	1319	100	1472
014	100	2099	100	2116	100	1609	100	1578
015	100	1293	100	1249	100	533	100	813
016	100	1558	100	1424	100	1556	100	629
017	100	1152	100	1316	100	715	100	1633

018	100	1663	70	2403	100	1257	100	1355
019	100	1551	100	976	100	733	100	947
020	70	2272	100	2055	100	1258	100	1430
021	100	977	100	1114	100	482	100	721
022	100	1446	100	1842	100	992	100	989
023	100	1874	100	1588	100	1120	100	983
024	100	2425	100	1953	100	1442	100	1600
025	100	2272	100	2634	100	1802	100	1330
026	70	2254	70	2942	100	1439	100	2952
027	70	1962	70	2237	100	1947	100	2756
028	100	2571	70	1996	100	2219	100	2096
029	100	1760	100	1916	100	1037	100	1283
030	100	1316	100	905	100	511	100	589
031	70	2035	100	2644	100	1641	100	1747
032	70	2396	100	2160	100	1785	100	1599
033	100	1792	100	1834	100	1112	100	1317
034	100	2048	100	2458	100	1542	100	1987
035	100	2490	100	2651	100	1638	100	2429
036	100	2368	100	1767	100	1339	100	1205
037	100	2114	70	2043	100	1944	100	1445
038	100	1472	100	1485	100	1123	100	1081
039	100	1729	100	2120	100	1306	100	601
040	100	2323	100	1745	100	1149	100	1509
041	100	2308	100	1662	100	1200	100	747
042	100	1970	100	1545	100	1361	100	1343
043	100	1652	100	1416	100	821	100	1363
044	100	2452	100	2675	100	1776	100	1307
045	100	2531	100	2048	100	1949	100	1311
046	100	2145	100	1371	100	1393	100	1039
047	70	2571	100	1874	100	2671	100	2522
048	100	1481	100	1406	100	873	100	1132
049	100	1717	100	1449	100	1011	100	1003
050	100	1607	100	912	100	577	100	552

Appendix 3. Numbers of relevant documents

	C		J		K		E		CJKE	
topic	S+A	S+A+B	S+A	S+A+B	S+A	S+A+B	S+A	S+A+B	S+A	S+A+B
001	39	56	8	11	26	59	10	22	83	148
002	23	38	45	239	11	21	107	151	186	449
003	76	106	61	257	95	126	193	250	425	739
004	21	26	13	14	5	6	10	10	49	56
005	29	36	124	156	16	25	75	122	244	339
006	31	47	26	45	27	39	74	100	158	231
007	25	39	6	7	10	15	16	19	57	80
008	27	51	25	44	14	34	33	49	99	178
009	117	158	98	116	93	97	277	315	585	686
010	128	143	138	198	89	103	155	231	510	675
011	50	73	10	35	49	56	15	27	124	191
012	64	115	19	29	56	57	56	62	195	263

013	15	60	47	104	25	28	68	79	155	271
014	38	119	89	107	31	35	46	70	204	331
015	39	264	78	106	25	37	17	64	159	471
016	55	106	35	48	66	133	132	145	288	432
017	78	148	90	108	25	36	129	210	322	502
018	43	84	24	40	23	50	17	22	107	196
019	12	35	21	43	39	47	16	26	88	151
020	6	6	23	25	20	25	11	16	60	72
021	10	18	2	32	46	68	12	46	70	164
022	28	73	51	297	44	68	160	250	283	688
023	18	24	1	35	15	20	50	57	84	136
024	28	44	16	30	7	8	6	8	57	90
025	140	151	10	20	144	161	28	116	322	448
026	34	66	9	80	11	41	0	7	54	194
027	80	94	59	74	11	15	9	13	159	196
028	12	46	7	12	5	10	3	13	27	81
029	187	196	29	73	44	52	31	32	291	353
030	54	60	29	59	14	20	22	22	119	161
031	7	54	5	20	10	15	8	32	30	121
032	11	27	14	20	35	48	90	92	150	187
033	18	26	32	118	24	34	103	103	177	281
034	51	54	293	354	153	196	78	82	575	686
035	13	16	8	13	31	58	11	11	63	98
036	25	34	23	23	32	75	10	10	90	142
037	6	8	17	41	54	54	64	66	141	169
038	3	7	51	94	68	85	167	167	289	353
039	13	14	2	4	6	29	14	14	35	61
040	15	20	8	8	33	37	26	26	82	91
041	6	7	13	181	4	4	45	57	68	249
042	31	33	9	166	109	194	179	216	328	609
043	3	5	5	39	11	31	31	38	50	113
044	7	12	23	44	11	25	174	241	215	322
045	3	4	7	11	9	38	5	17	24	70
046	8	8	29	63	6	9	28	29	71	109
047	5	7	15	35	31	69	64	64	115	175
048	62	84	119	196	47	62	95	143	323	485
049	25	40	136	182	13	17	26	29	200	268
050	66	110	115	205	56	111	77	80	314	506

Appendix 4. Recall-precision curves by type of runs

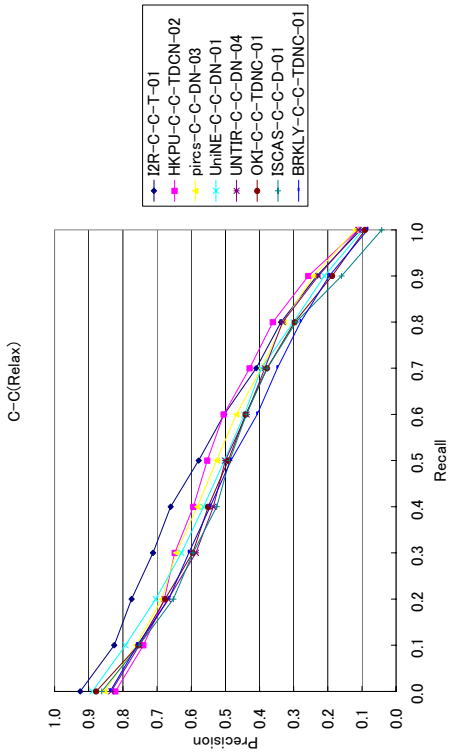
The following recall-precision graphs show top-ranked runs according to MAP values by type of runs. For example,

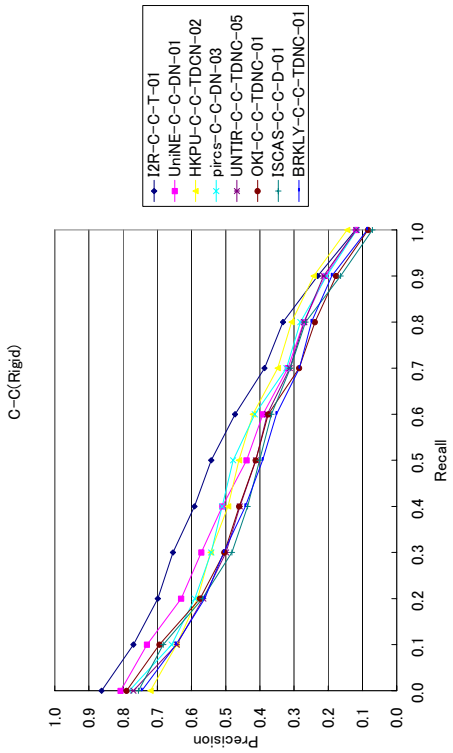
C-C: all C-C monolingual runs

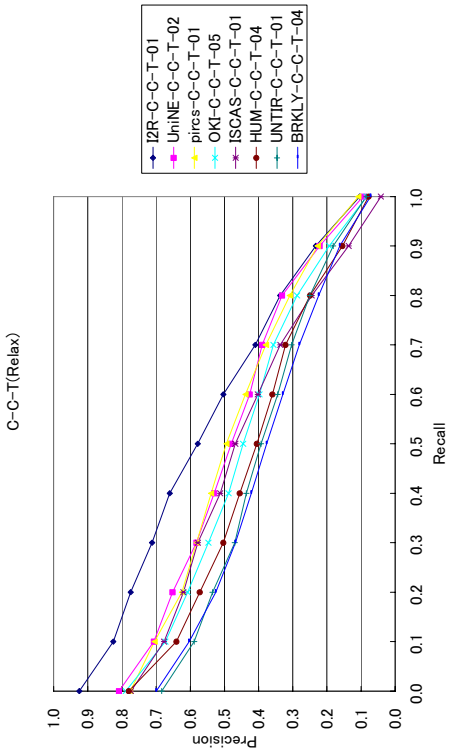
C-C-T: all C-C <TITLE>-only runs (T-runs)

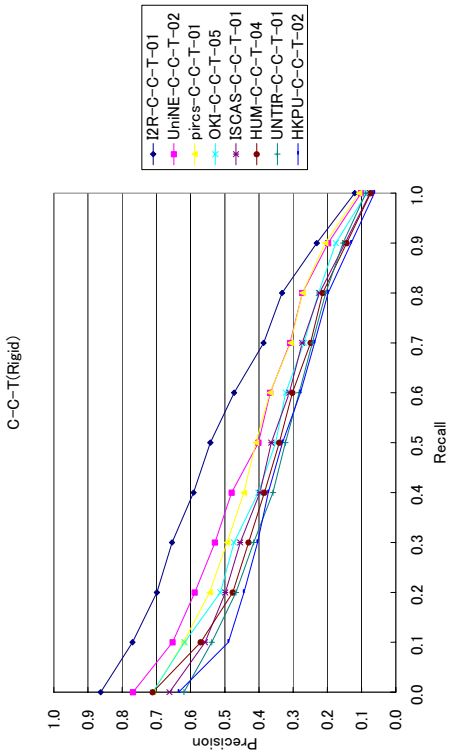
C-C-D: all C-C <DESC>-only runs (D-runs)

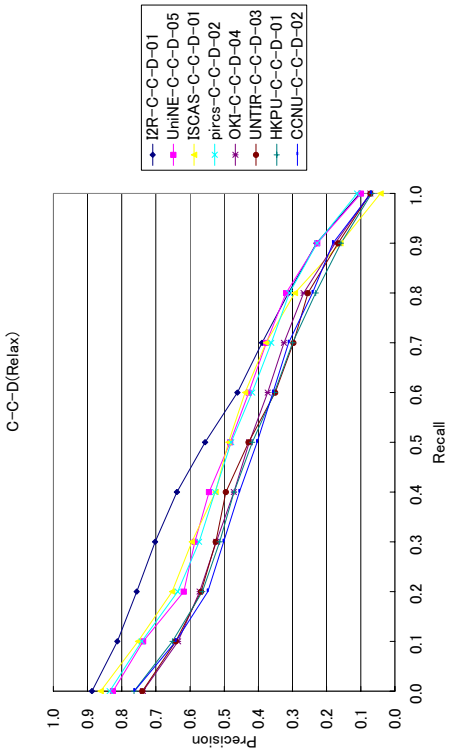
It should be noted that only the best run of each research group is picked up by types of runs, and that each page includes two graphs, i.e., one is based on rigid relevance and the other relaxed relevance.

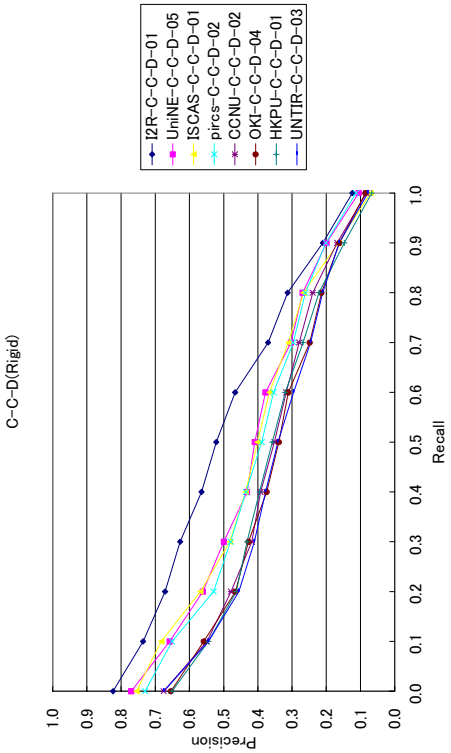

C-C(Relax)
Precision
Recall
I2R-C-C-T-01
HKPU-C-C-TDCN-02
pircs-C-C-DN-03
UniNE-C-C-DN-01
UNTIR-C-C-DN-04
OKI-C-C-TDNC-01
ISCAS-C-C-D-01
BRKLY-C-C-TDNC-01

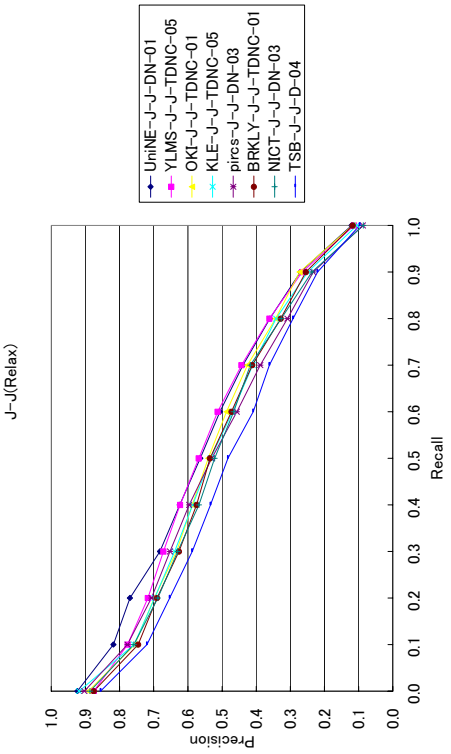

C-C(Rigid)
Precision
Recall
I2R-C-C-T-01
UniNE-C-C-DN-01
HKPU-C-C-TDCN-02
pircs-C-C-DN-03
UNTIR-C-C-TDNC-05
OKI-C-C-TDNC-01
ISCAS-C-C-D-01
BRKLY-C-C-TDNC-01

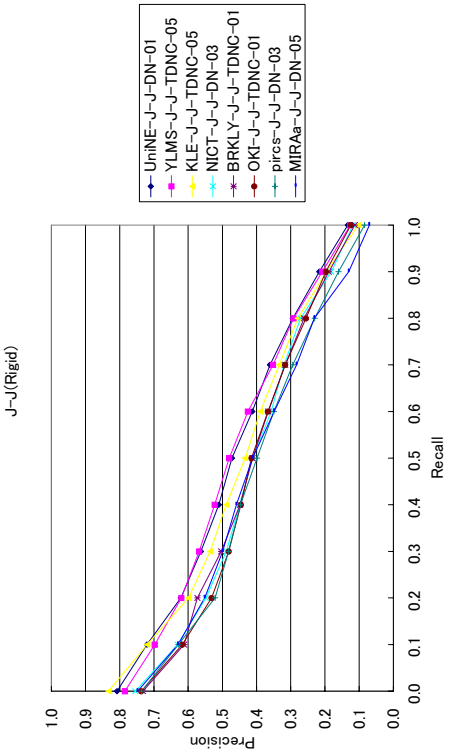

C-C-T(Relax)
Precision
Recall
I2R-C-C-T-01
UniNE-C-C-T-02
pircs-C-C-T-01
OKI-C-C-T-05
ISCAS-C-C-T-01
HUM-C-C-T-04
UNTIR-C-C-T-01
BRKLY-C-C-T-04


C-C-T(Rigid)
Precision
Recall
I2R-C-C-T-01
UniNE-C-C-T-02
pircs-C-C-T-01
OKI-C-C-T-05
ISCAS-C-C-T-01
HUM-C-C-T-04
UNTIR-C-C-T-01
HKPU-C-C-T-02

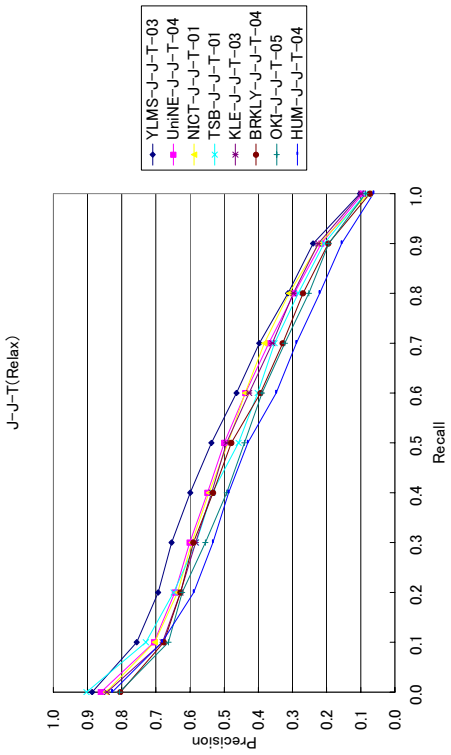


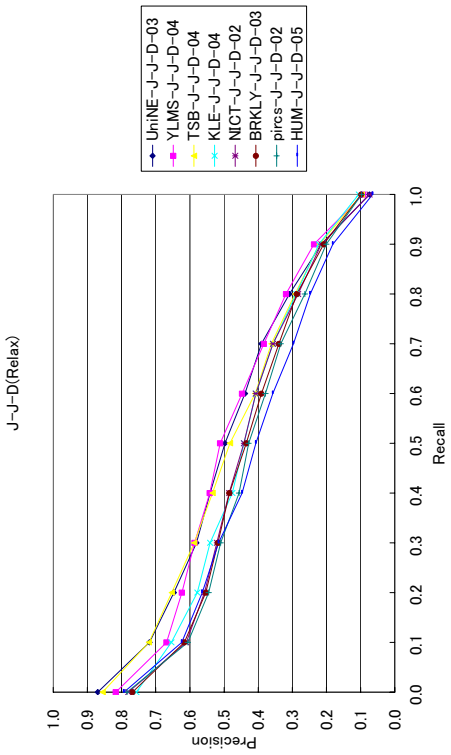


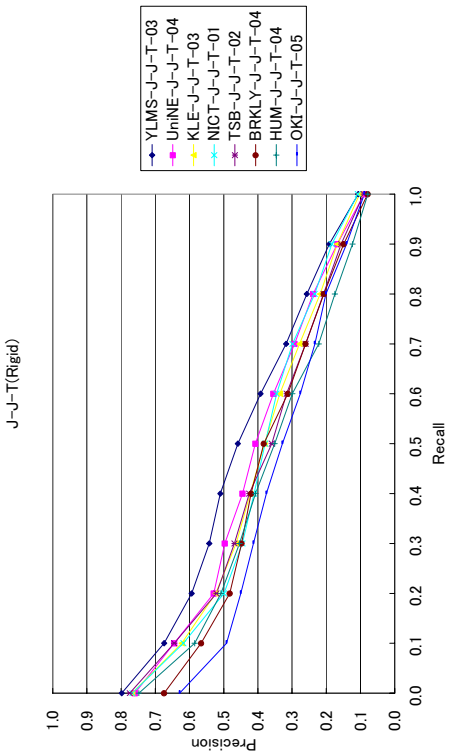


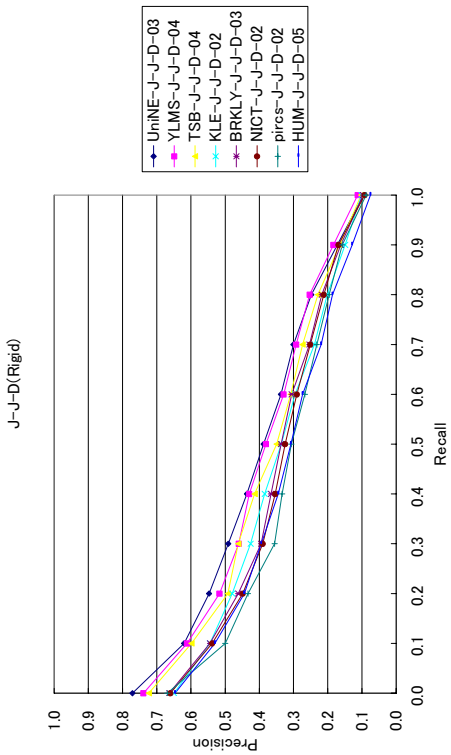


*Note: The runs of YLMS and MIRAa were submitted after deadline.

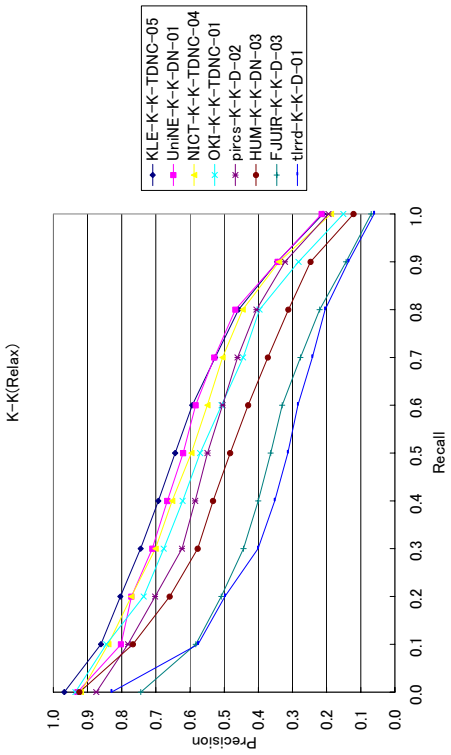


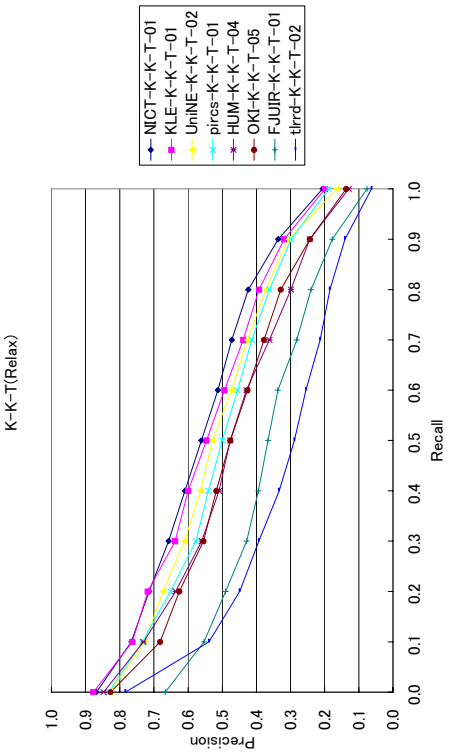


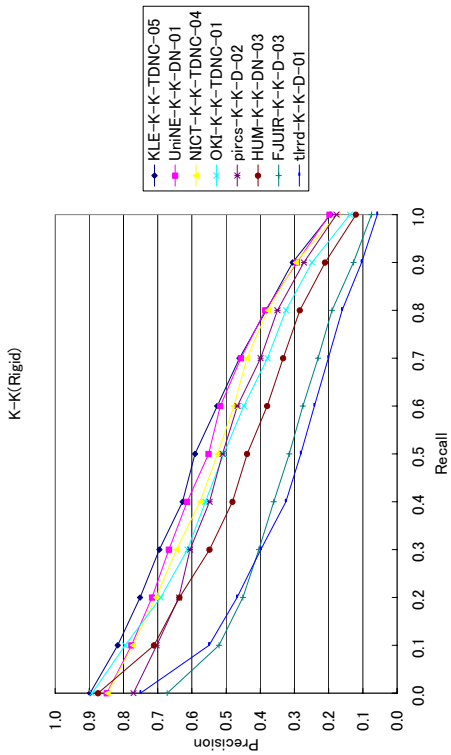


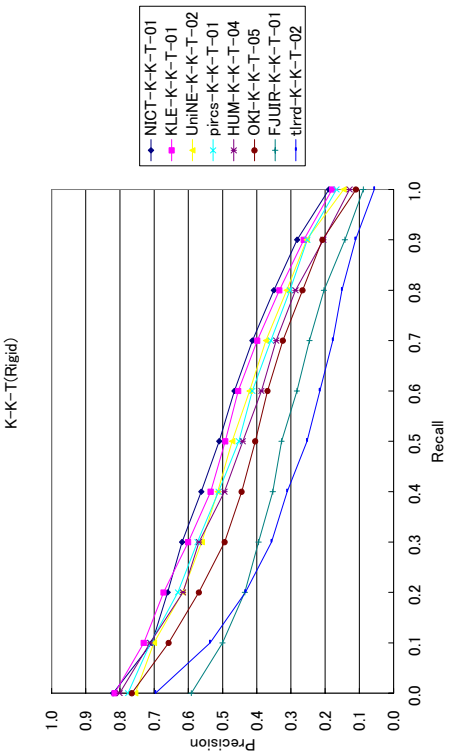


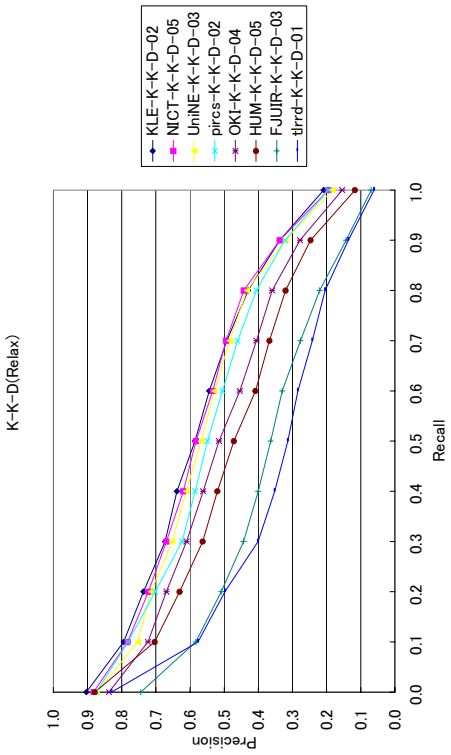
*Note: The run of YLMS was submitted after deadline.

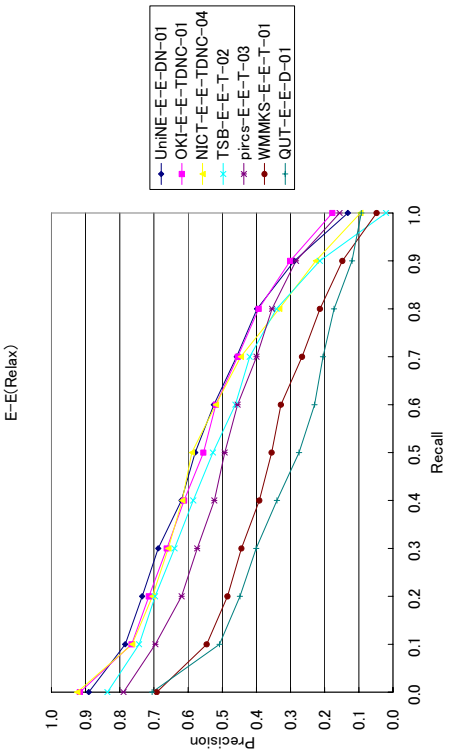

K-K(Relax)
Precision
Recall
KLE-K-K-TDNC-05
UniNE-K-K-DN-01
NICT-K-K-TDNC-04
OKI-K-K-TDNC-01
pircs-K-K-D-02
HUM-K-K-DN-03
FJUIR-K-K-D-03
tlrrd-K-K-D-01

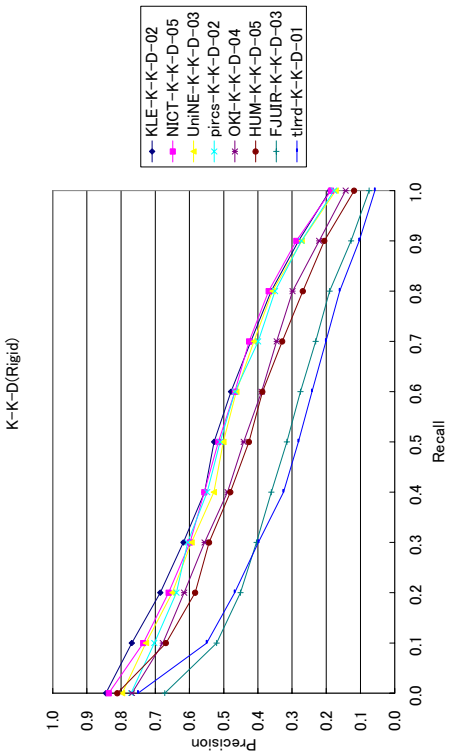

K-K-T(Relax)
Precision
Recall
NICT-K-K-T-01
KLE-K-K-T-01
UniNE-K-K-T-02
pircs-K-K-T-01
HUM-K-K-T-04
OKI-K-K-T-05
FJUIR-K-K-T-01
tlrrd-K-K-T-02

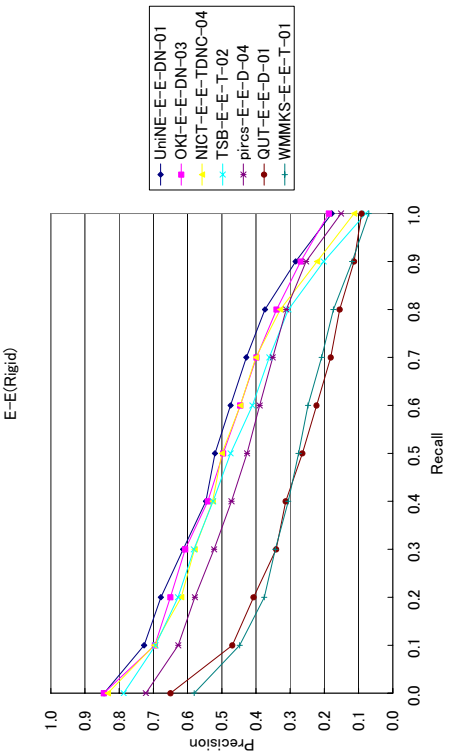

K-K(Rigid)
Precision
Recall
KLE-K-K-TDNC-05
UniNE-K-K-DN-01
NICT-K-K-TDNC-04
OKI-K-K-TDNC-01
pircs-K-K-D-02
HUM-K-K-DN-03
FJUIR-K-K-D-03
tlrrd-K-K-D-01

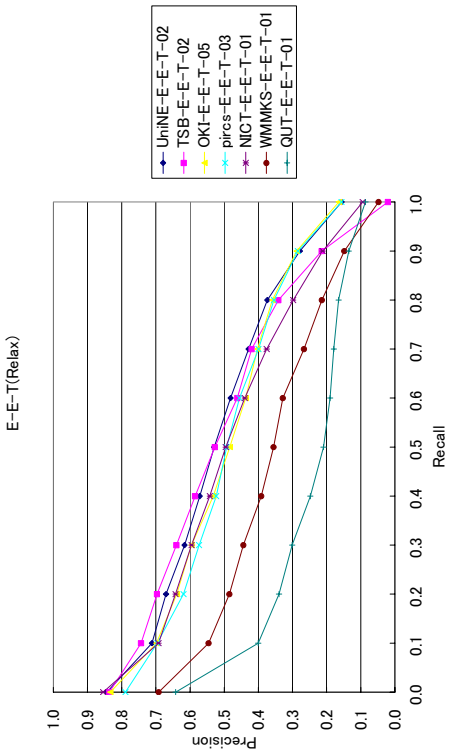

K-K-T(Rigid)
Precision
Recall
NICT-K-K-T-01
KLE-K-K-T-01
UniNE-K-K-T-02
pircs-K-K-T-01
HUM-K-K-T-04
OKI-K-K-T-05
FJUIR-K-K-T-01
tlrrd-K-K-T-02

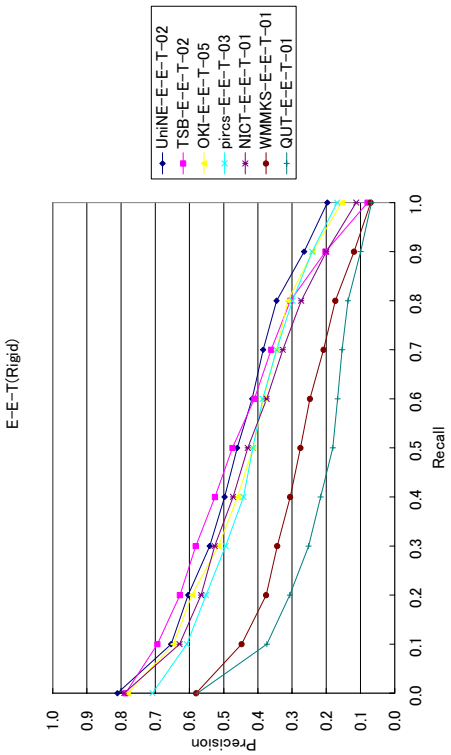

K-K-D(Relax)
Precision
Recall
KLE-K-K-D-02
NICT-K-K-D-05
UniNE-K-K-D-03
pircs-K-K-D-02
OKI-K-K-D-04
HUM-K-K-D-05
FJUIR-K-K-D-03
tlrrd-K-K-D-01

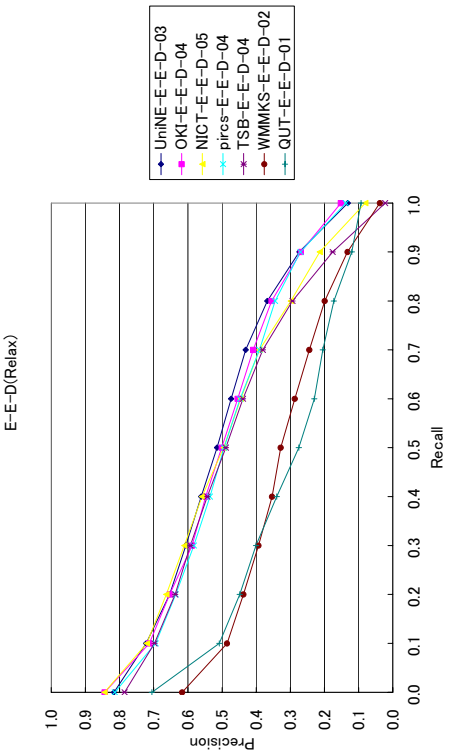

E-E(Relax)
Precision
Recall
UniNE-E-E-DN-01
OKI-E-E-TDNC-01
NICT-E-E-TDNC-04
TSB-E-E-T-02
pircs-E-E-T-03
WMMKS-E-E-T-01
QUT-E-E-D-01

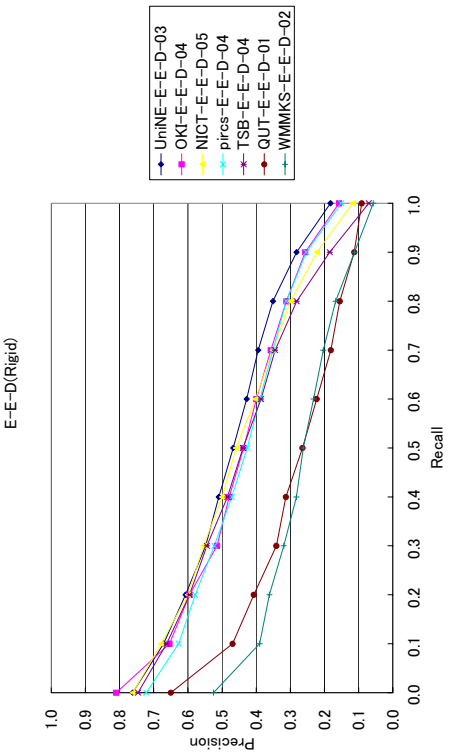

K-K-D(Rigid)
Precision
Recall
KLE-K-K-D-02
NICT-K-K-D-05
UniNE-K-K-D-03
pircs-K-K-D-02
OKI-K-K-D-04
HUM-K-K-D-05
FJUIR-K-K-D-03
tlrrd-K-K-D-01

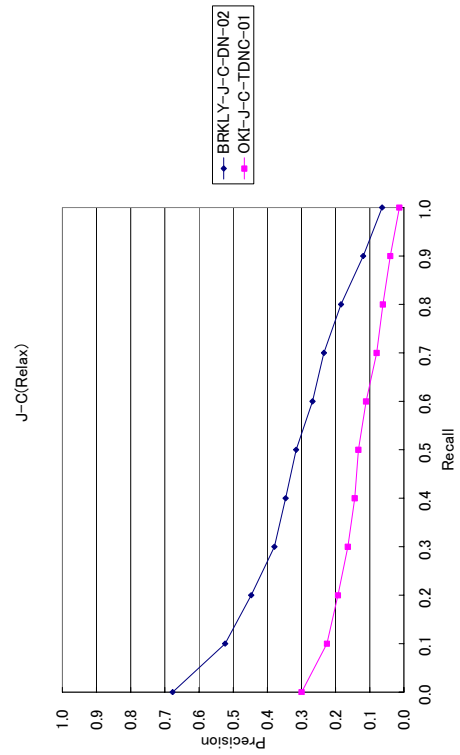

E-E(Rigid)
Precision
Recall
UniNE-E-E-DN-01
OKI-E-E-DN-03
NICT-E-E-TDNC-04
TSB-E-E-T-02
pircs-E-E-D-04
QUT-E-E-D-01
WMMKS-E-E-T-01

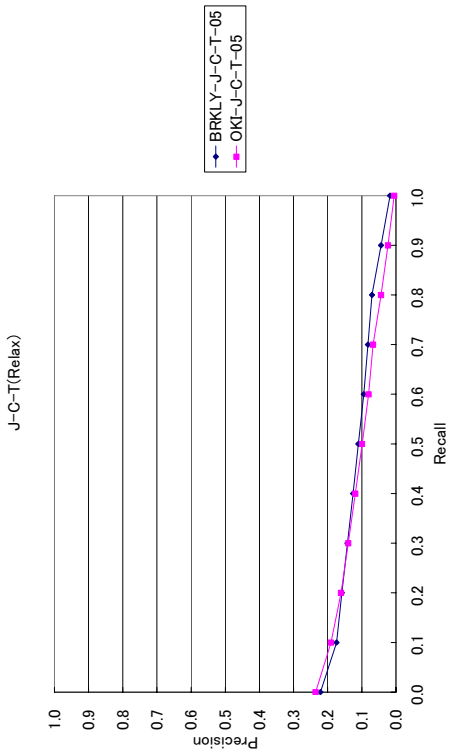

E-E-T(Relax)
Precision
Recall
UniNE-E-E-T-02
TSB-E-E-T-02
OKI-E-E-T-05
pircs-E-E-T-03
NICT-E-E-T-01
WMMKS-E-E-T-01
QUT-E-E-T-01

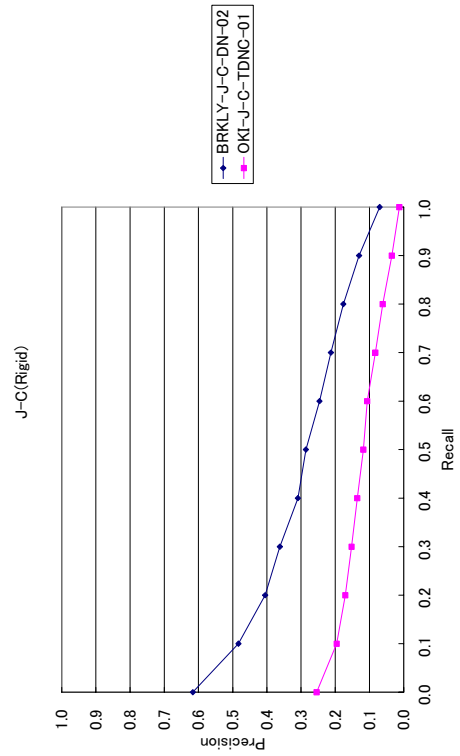

E-E-T(Rigid)
Precision
Recall
UniNE-E-E-T-02
TSB-E-E-T-02
OKI-E-E-T-05
pircs-E-E-T-03
NICT-E-E-T-01
WMMKS-E-E-T-01
QUT-E-E-T-01

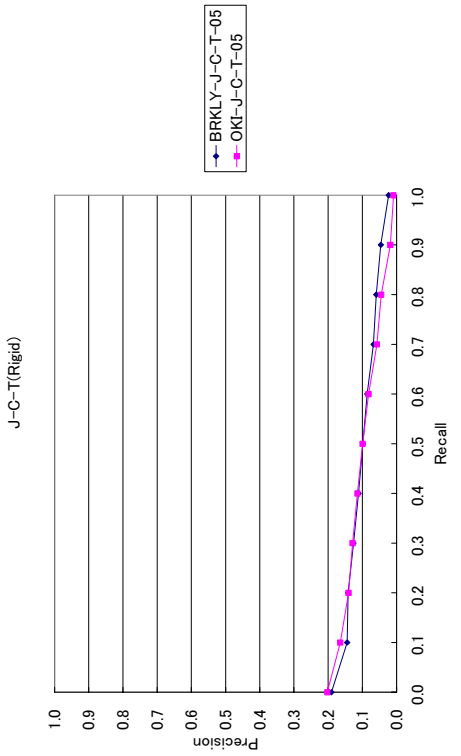

E-E-D(Relax)
Precision
Recall
UniNE-E-E-D-03
OKI-E-E-D-04
NICT-E-E-D-05
pircs-E-E-D-04
TSB-E-E-D-04
WMMKS-E-E-D-02
QUT-E-E-D-01

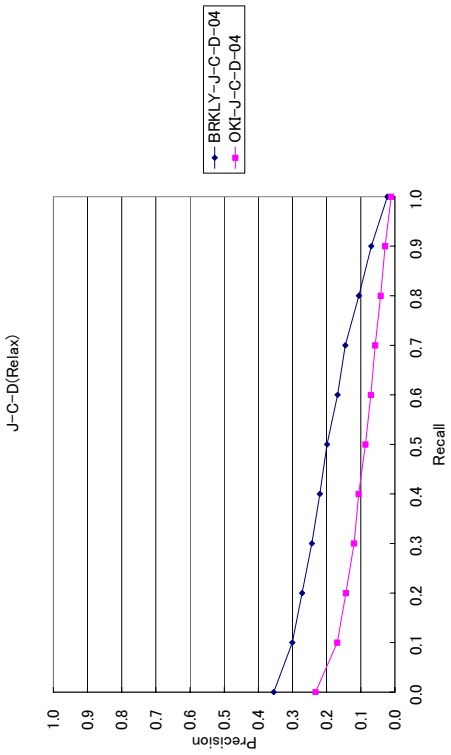

E-E-D(Rigid)
Precision
Recall
UniNE-E-E-D-03
OKI-E-E-D-04
NICT-E-E-D-05
pircs-E-E-D-04
TSB-E-E-D-04
QUT-E-E-D-01
WMMKS-E-E-D-02

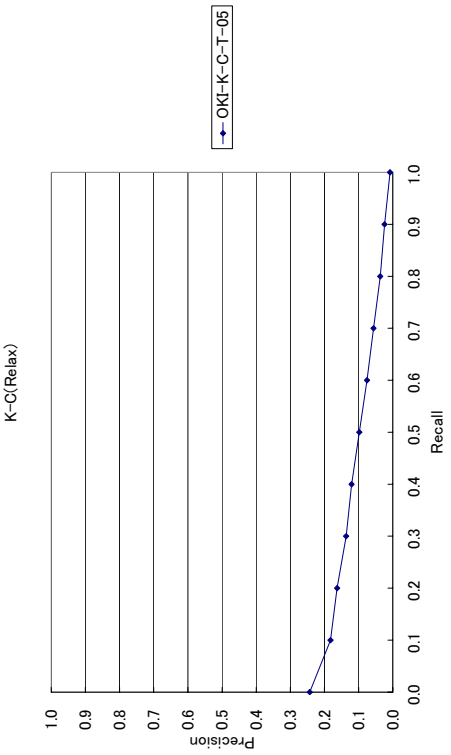

J-C(Relax)
BRKLY-J-C-DN-02
OKI-J-C-TDNC-01
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

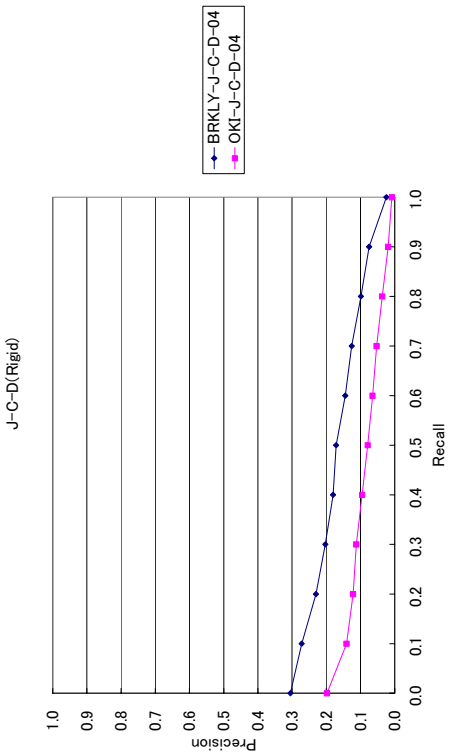

J-C-T(Relax)
BRKLY-J-C-T-05
OKI-J-C-T-05
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

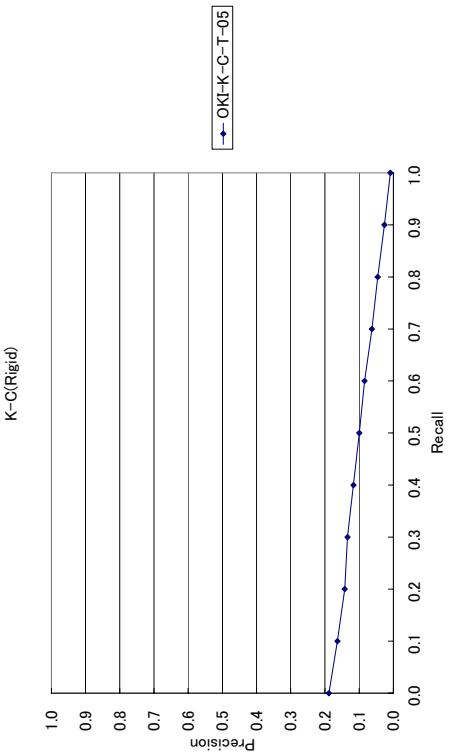

J-C(Rigid)
BRKLY-J-C-DN-02
OKI-J-C-TDNC-01
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

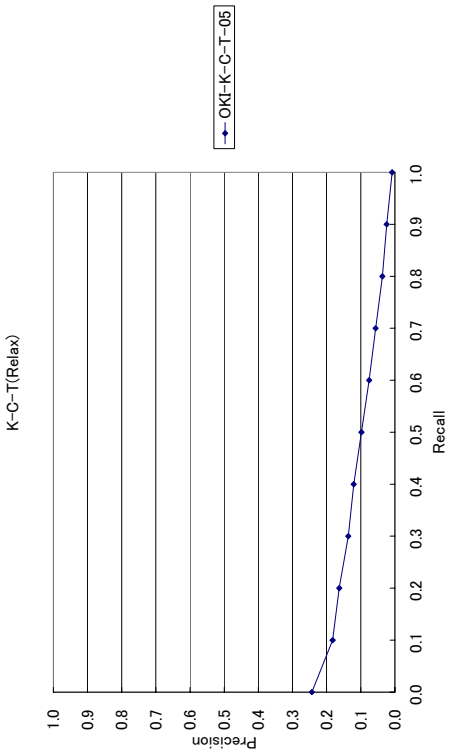

J-C-T(Rigid)
BRKLY-J-C-T-05
OKI-J-C-T-05
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

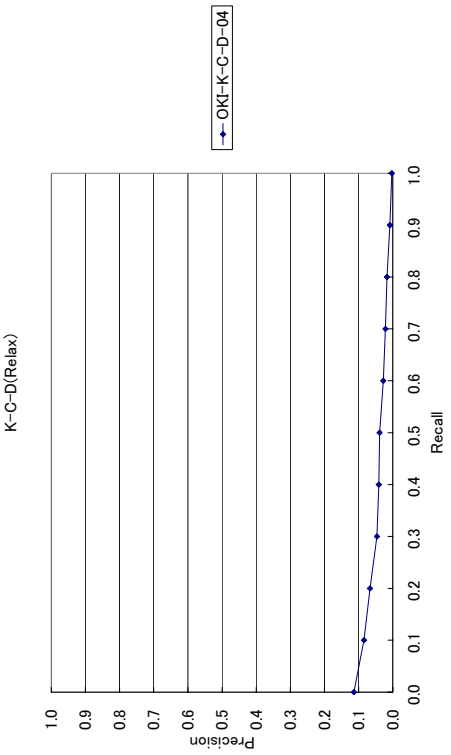

J-C-D(Relax)
BRKLY-J-C-D-04
OKI-J-C-D-04
Precision
Recall

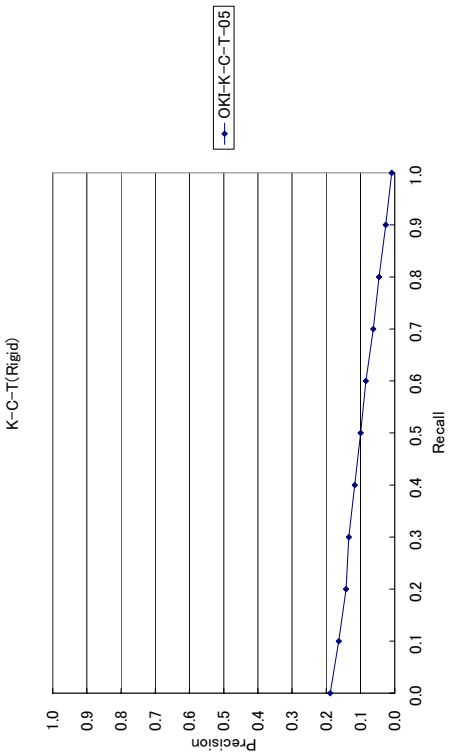

K-C(Relax)
OKI-K-C-T-05
Precision
Recall

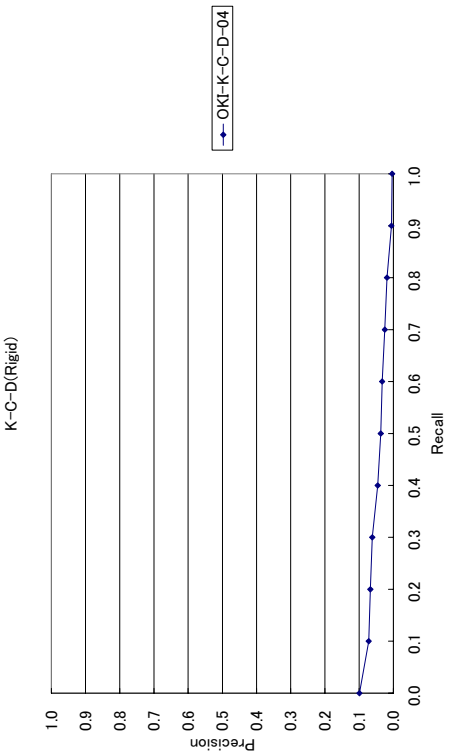

J-C-D(Rigid)
BRKLY-J-C-D-04
OKI-J-C-D-04
Precision
Recall

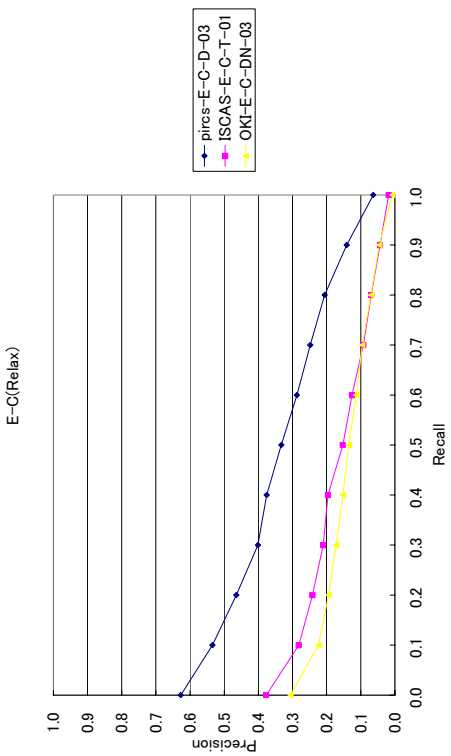

K-C(Rigid)
OKI-K-C-T-05
Precision
Recall

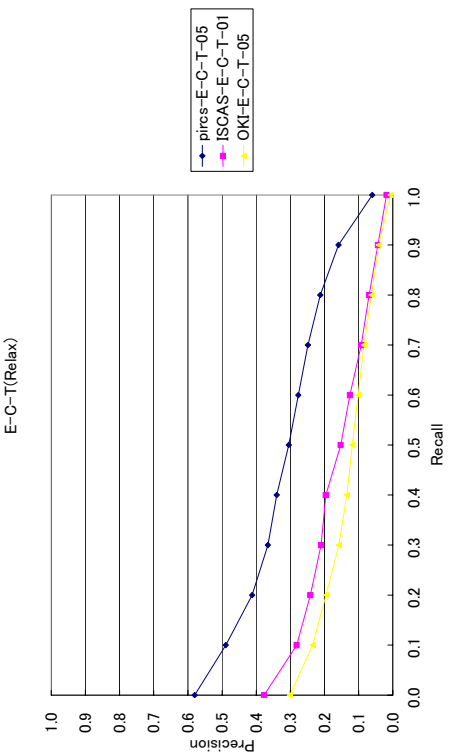

K-C-T(Relax)
OKI-K-C-T-05
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

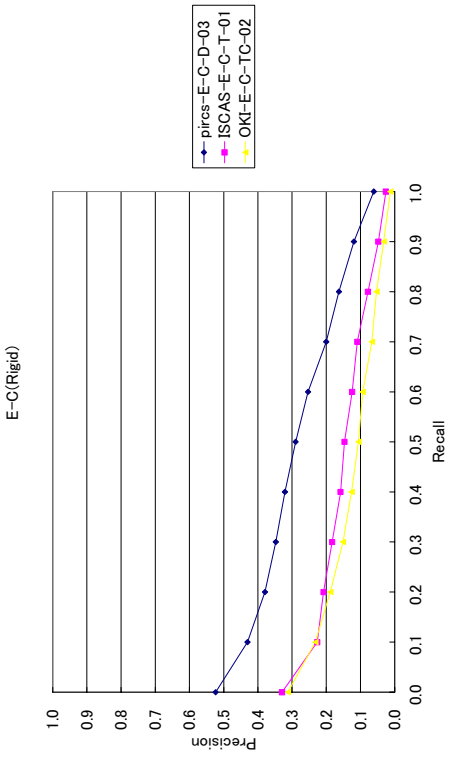

K-C-D(Relax)
OKI-K-C-D-04
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

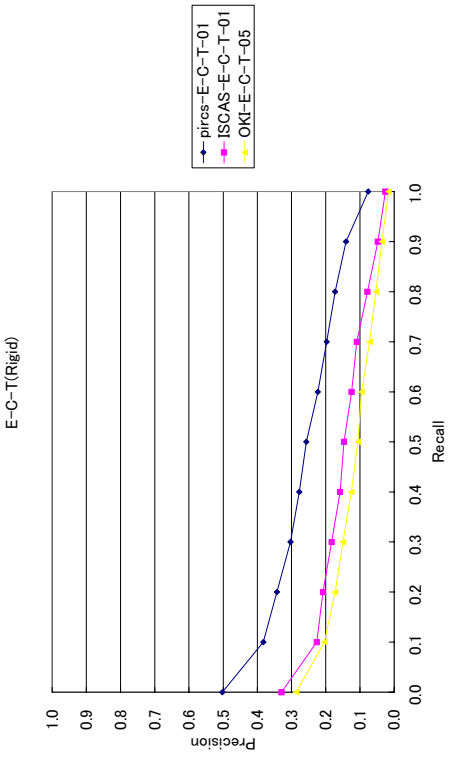

K-C-T(Rigid)
OKI-K-C-T-05
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

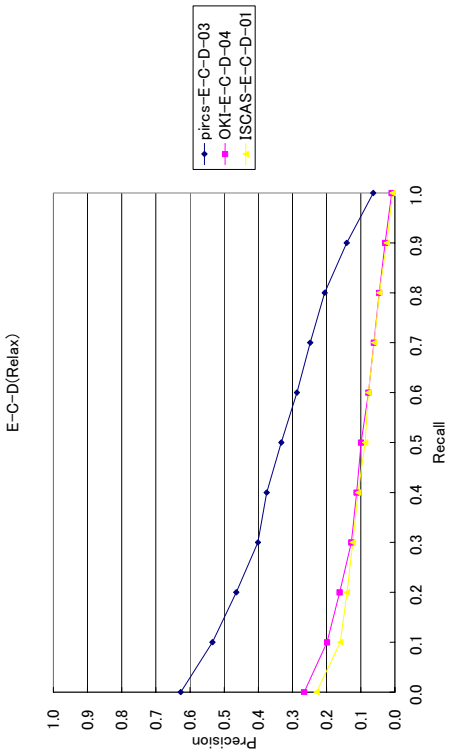

K-C-D(Rigid)
OKI-K-C-D-04
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

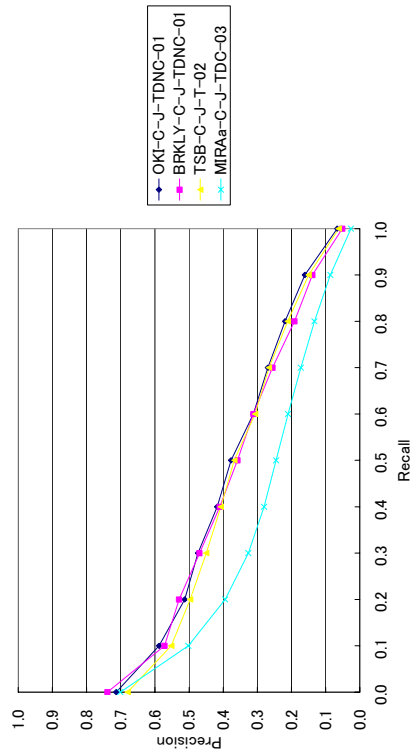

E-C(Relax)
pircs-E-C-D-03
ISCAS-E-C-T-01
OKI-E-C-DN-03
Precision
Recall

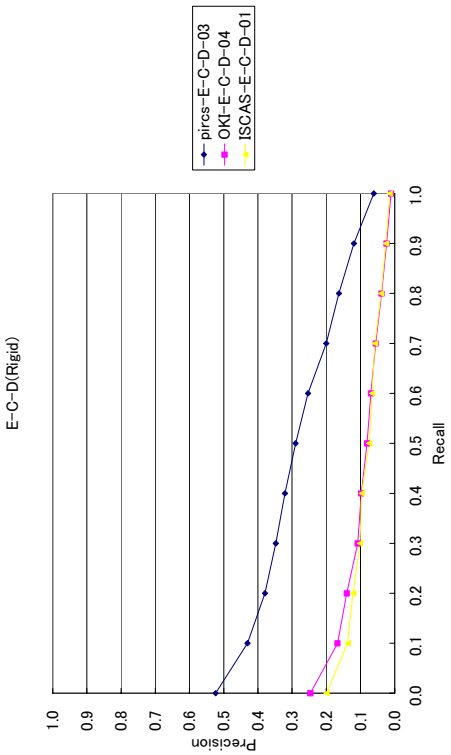

E-C-T(Relax)
pircs-E-C-T-05
ISCAS-E-C-T-01
OKI-E-C-T-05
Precision
Recall

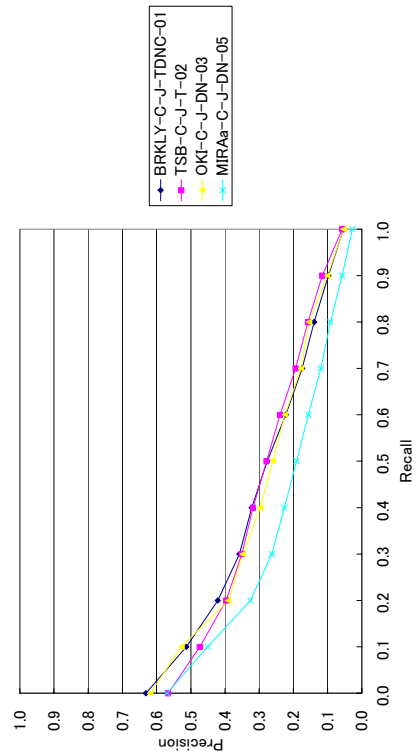

E-C(Rigid)
pircs-E-C-D-03
ISCAS-E-C-T-01
OKI-E-C-TC-02
Precision
Recall

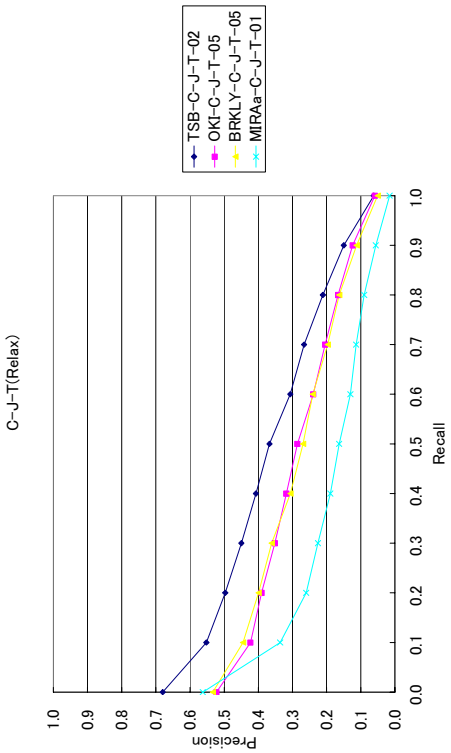

E-C-T(Rigid)
pircs-E-C-T-01
ISCAS-E-C-T-01
OKI-E-C-T-05
Precision
Recall

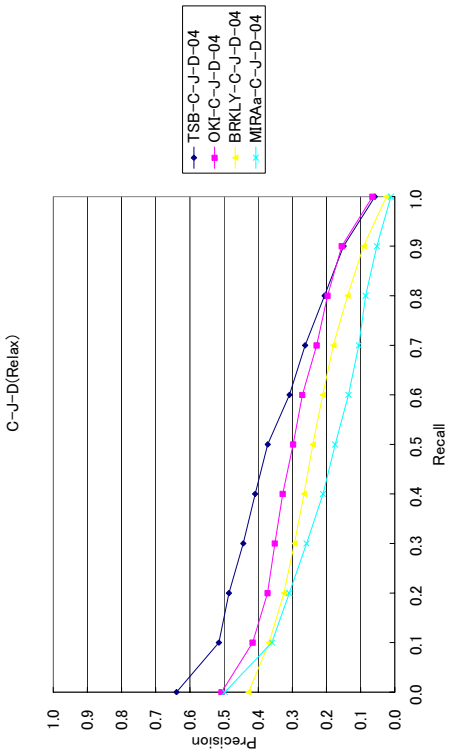

E-C-D(Relax)
pircs-E-C-D-03
OKI-E-C-D-04
ISCAS-E-C-D-01
Precision
Recall

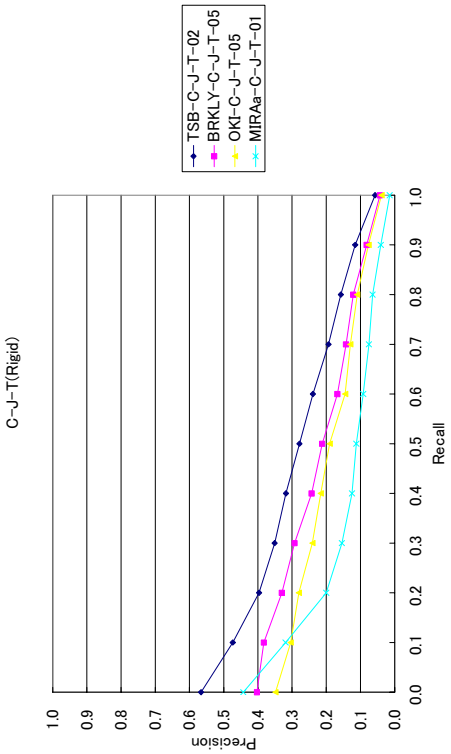

C-J(Relax)
OKI-C-J-TDNC-01
BRKLY-C-J-TDNC-01
TSB-C-J-T-02
MIRAa-C-J-TDC-03
Precision
Recall

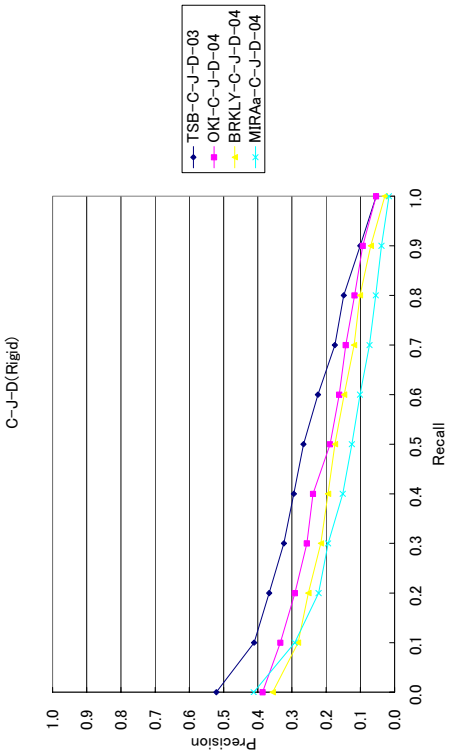

E-C-D(Rigid)
pircs-E-C-D-03
OKI-E-C-D-04
ISCAS-E-C-D-01
Precision
Recall

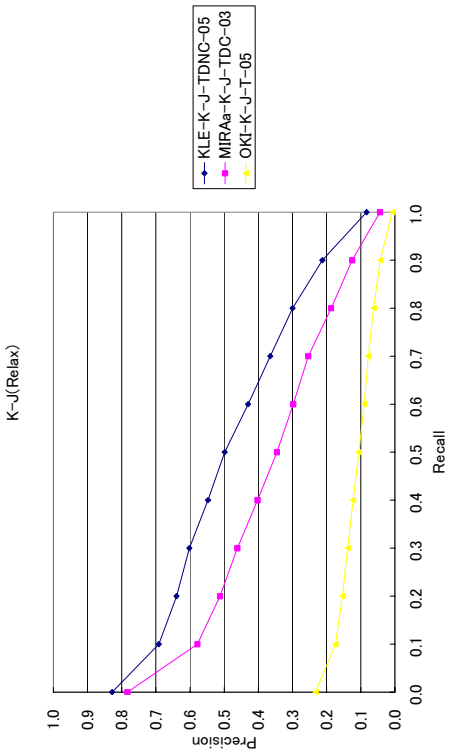

C-J(Rigid)
BRKLY-C-J-TDNC-01
TSB-C-J-T-02
OKI-C-J-DN-03
MIRAa-C-J-DN-05
Precision
Recall

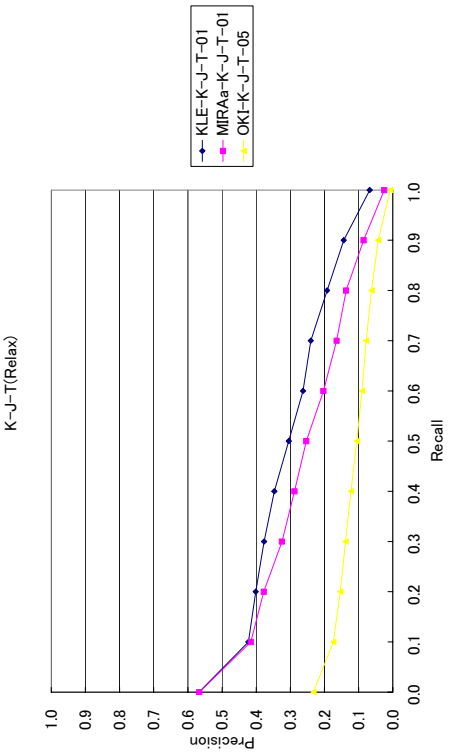

C-J-T(Relax)
TSB-C-J-T-02
OKI-C-J-T-05
BRKLY-C-J-T-05
MIRAa-C-J-T-01
Precision
Recall


C-J-D(Relax)
TSB-C-J-D-04
OKI-C-J-D-04
BRKLY-C-J-D-04
MIRAa-C-J-D-04
Precision
Recall


C-J-T(Rigid)
TSB-C-J-T-02
BRKLY-C-J-T-05
OKI-C-J-T-05
MIRAa-C-J-T-01
Precision
Recall


C-J-D(Rigid)
TSB-C-J-D-03
OKI-C-J-D-04
BRKLY-C-J-D-04
MIRAa-C-J-D-04
Precision
Recall


K-J(Relax)
KLE-K-J-TDNC-05
MIRAa-K-J-TDC-03
OKI-K-J-T-05
Precision
Recall


K-J-T(Relax)
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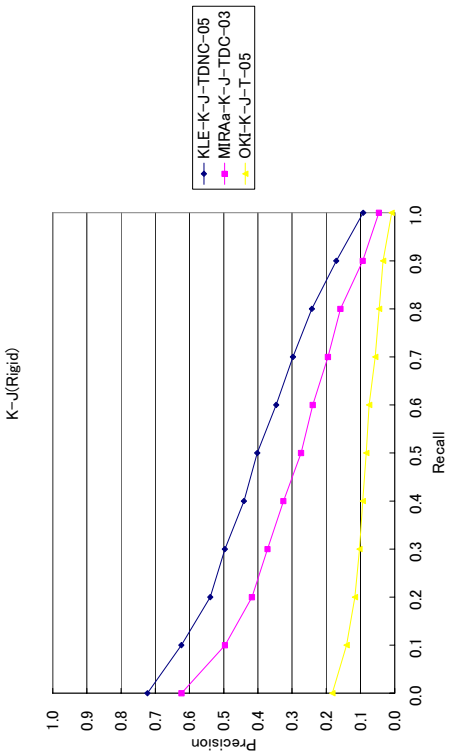
MIRAa-K-J-T-01
OKI-K-J-T-05
Precision
Recall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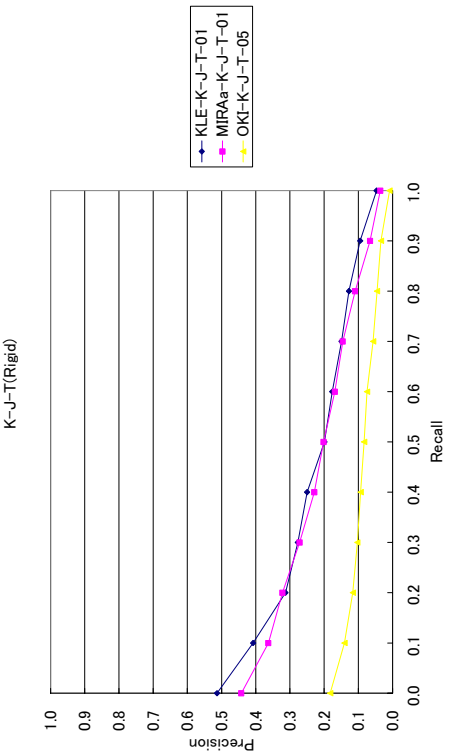
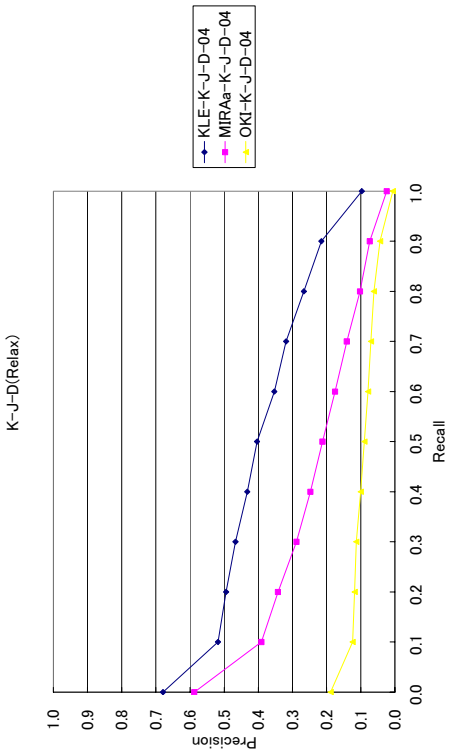
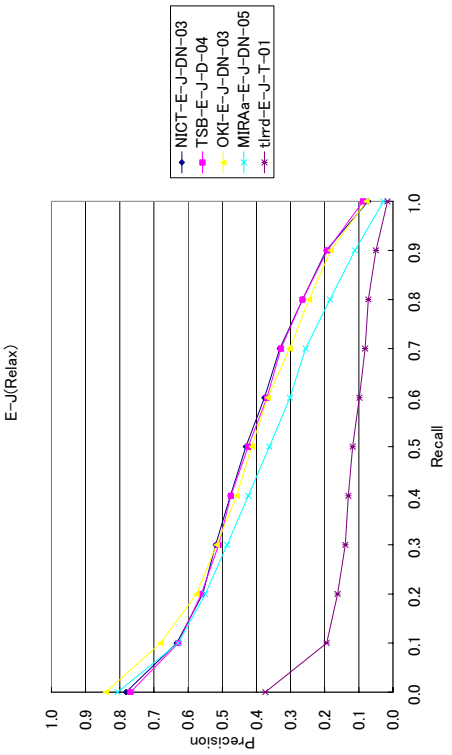
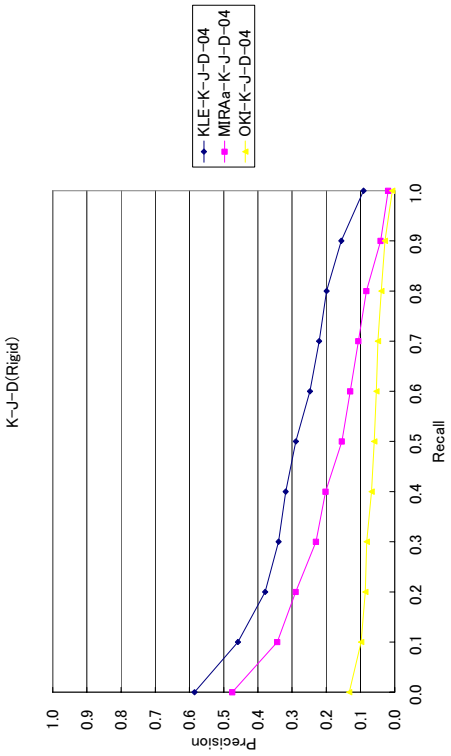
MIRAa-K-J-TDC-03
OKI-K-J-T-05
Precision
Recall


K-J-T(Rigid)
KLE-K-J-T-01
MIRAa-K-J-T-01
OKI-K-J-T-05
Precision
Recall


K-J-D(Relax)
KLE-K-J-D-04
MIRAa-K-J-D-04
OKI-K-J-D-04
Precision
Recall


E-J(Relax)
NICT-E-J-DN-03
TSB-E-J-D-04
OKI-E-J-DN-03
MIRAa-E-J-DN-05
tlrrd-E-J-T-01
Precision
Recall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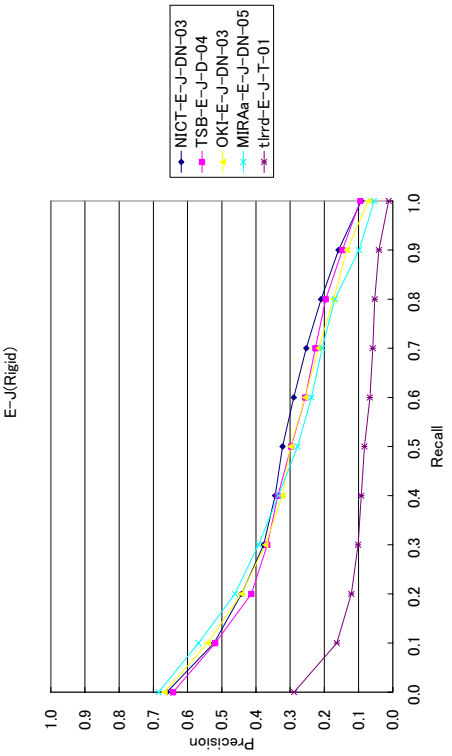
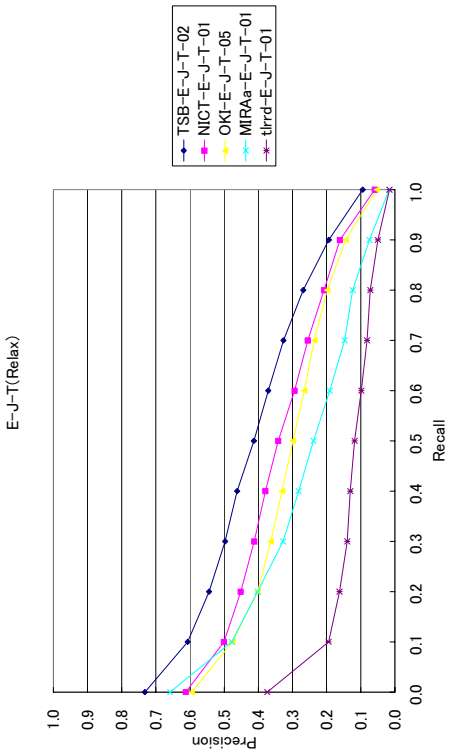
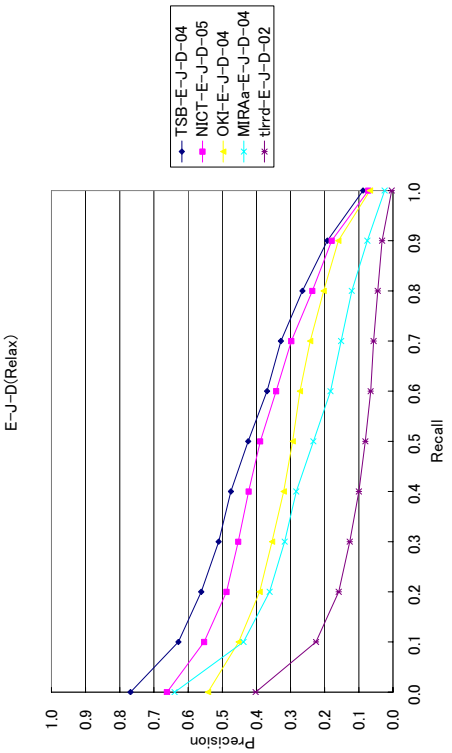
KLE-K-J-D-04
MIRAa-K-J-D-04
OKI-K-J-D-04
Precision
Recall


E-J(Rigid)
NICT-E-J-DN-03
TSB-E-J-D-04
OKI-E-J-DN-03
MIRAa-E-J-DN-05
tlrrd-E-J-T-01
Precision
Recall


E-J-T(Relax)
Precision
Recall
TSB-E-J-T-02
NICT-E-J-T-01
OKI-E-J-T-05
MIRAa-E-J-T-01
tlrrd-E-J-T-01


E-J-D(Relax)
Precision
Recall
TSB-E-J-D-04
NICT-E-J-D-05
OKI-E-J-D-04
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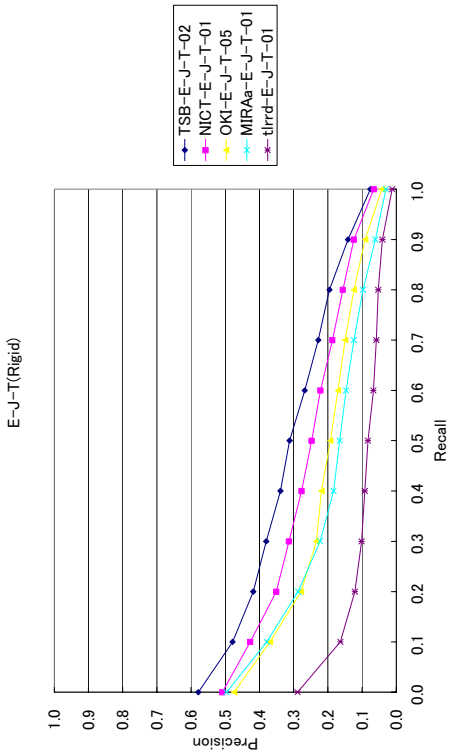
E-J-T(Rigid)
Precision
Recall
TSB-E-J-T-02
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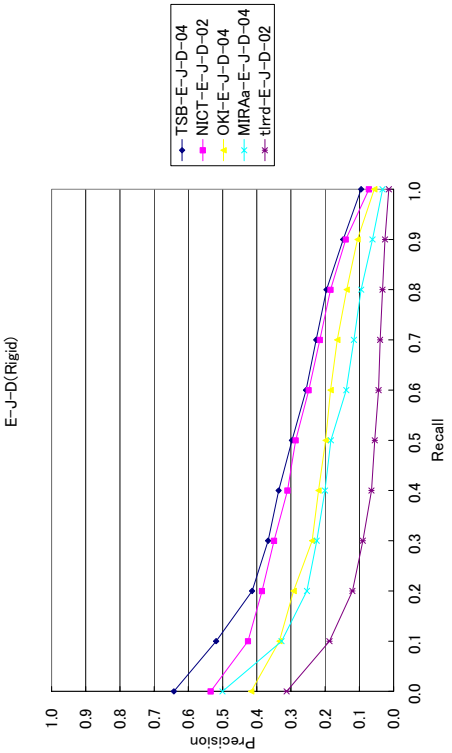
OKI-E-J-T-05
MIRAa-E-J-T-01
tlrrd-E-J-T-01


E-J-D(Rigid)
Precision
Recall
TSB-E-J-D-04
NICT-E-J-D-02
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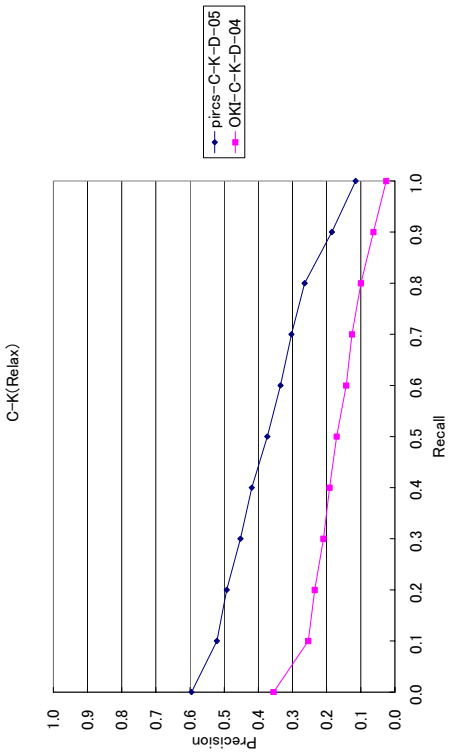
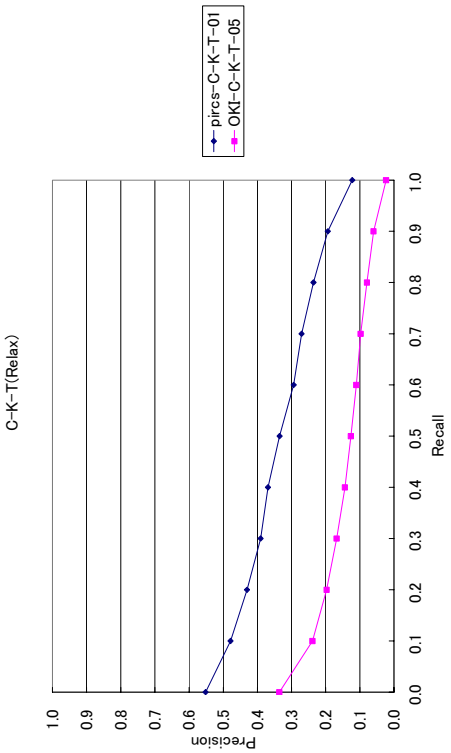
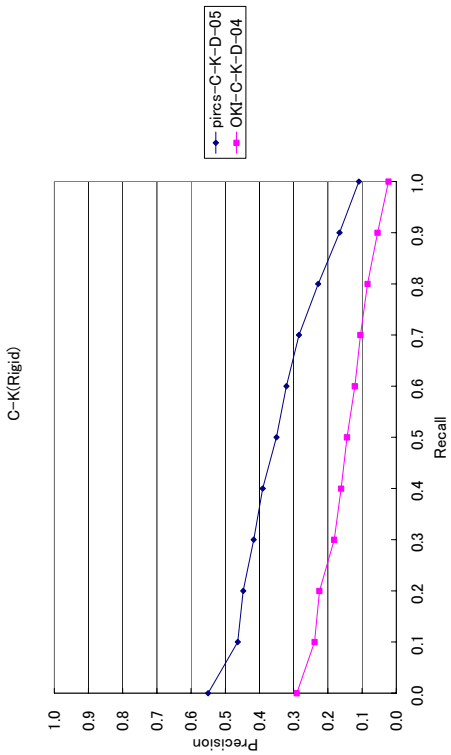
tlrrd-E-J-D-02


C-K(Relax)
pircs-C-K-D-05
OKI-C-K-D-04
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0


C-K-T(Relax)
pircs-C-K-T-01
OKI-C-K-T-05
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0


C-K(Rigid)
pircs-C-K-D-05
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Precision
Recall
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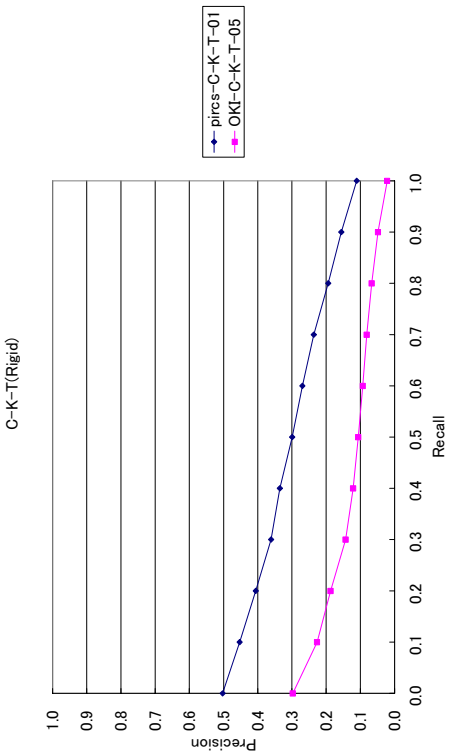
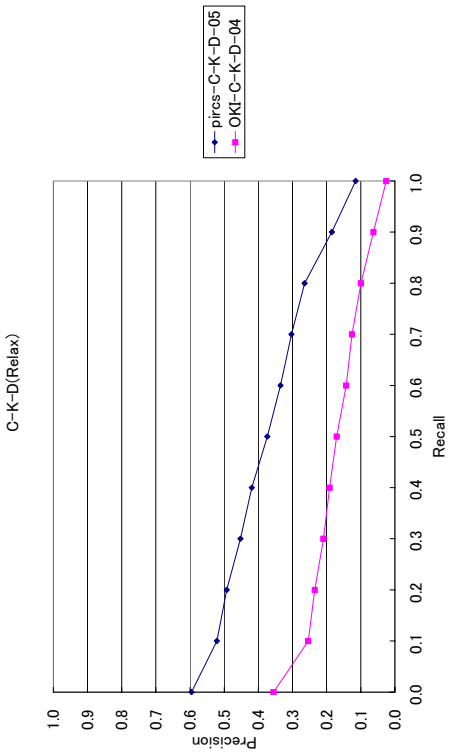

C-K-T(Rigid)
pircs-C-K-T-01
OKI-C-K-T-05
Precision
Recall
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0


C-K-D(Relax)
pircs-C-K-D-05
OKI-C-K-D-04
Precision
Recall
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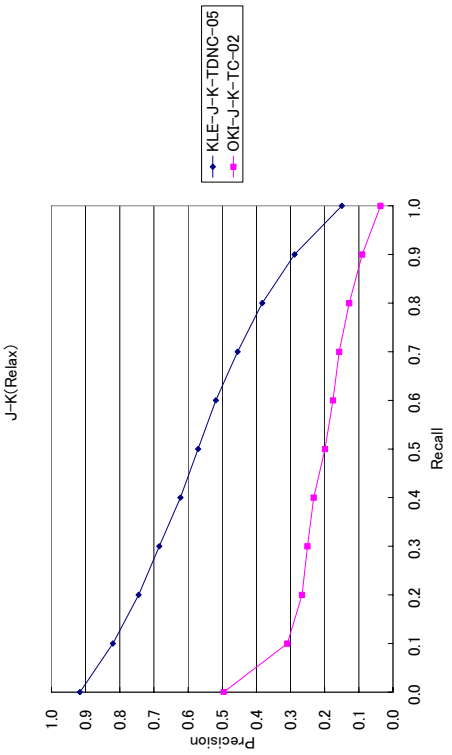
J-K(Relax)
KLE-J-K-TDNC-05
OKI-J-K-TC-02
Precision
Recall
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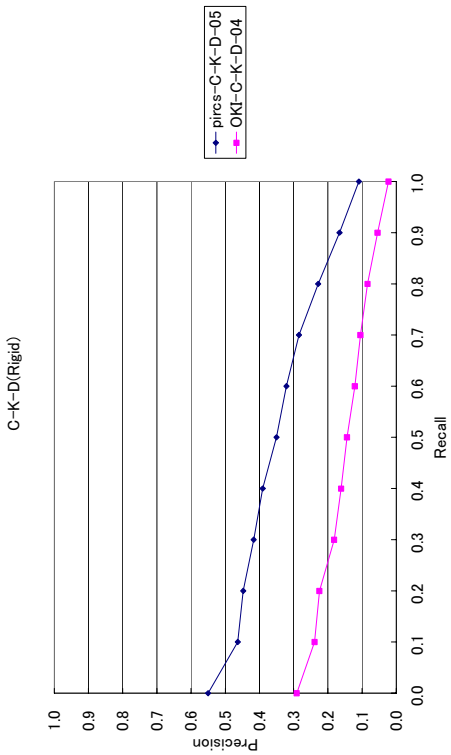
C-K-D(Rigid)
pircs-C-K-D-05
OKI-C-K-D-04
Precision
Recall
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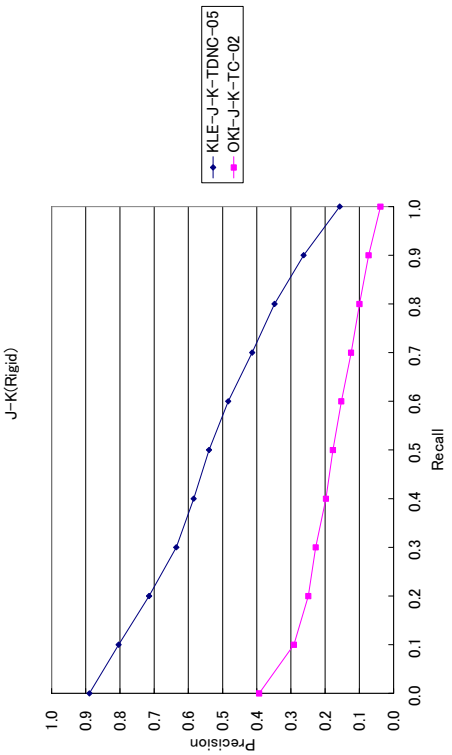
J-K(Rigid)
KLE-J-K-TDNC-05
OKI-J-K-TC-02
Precision
Recall
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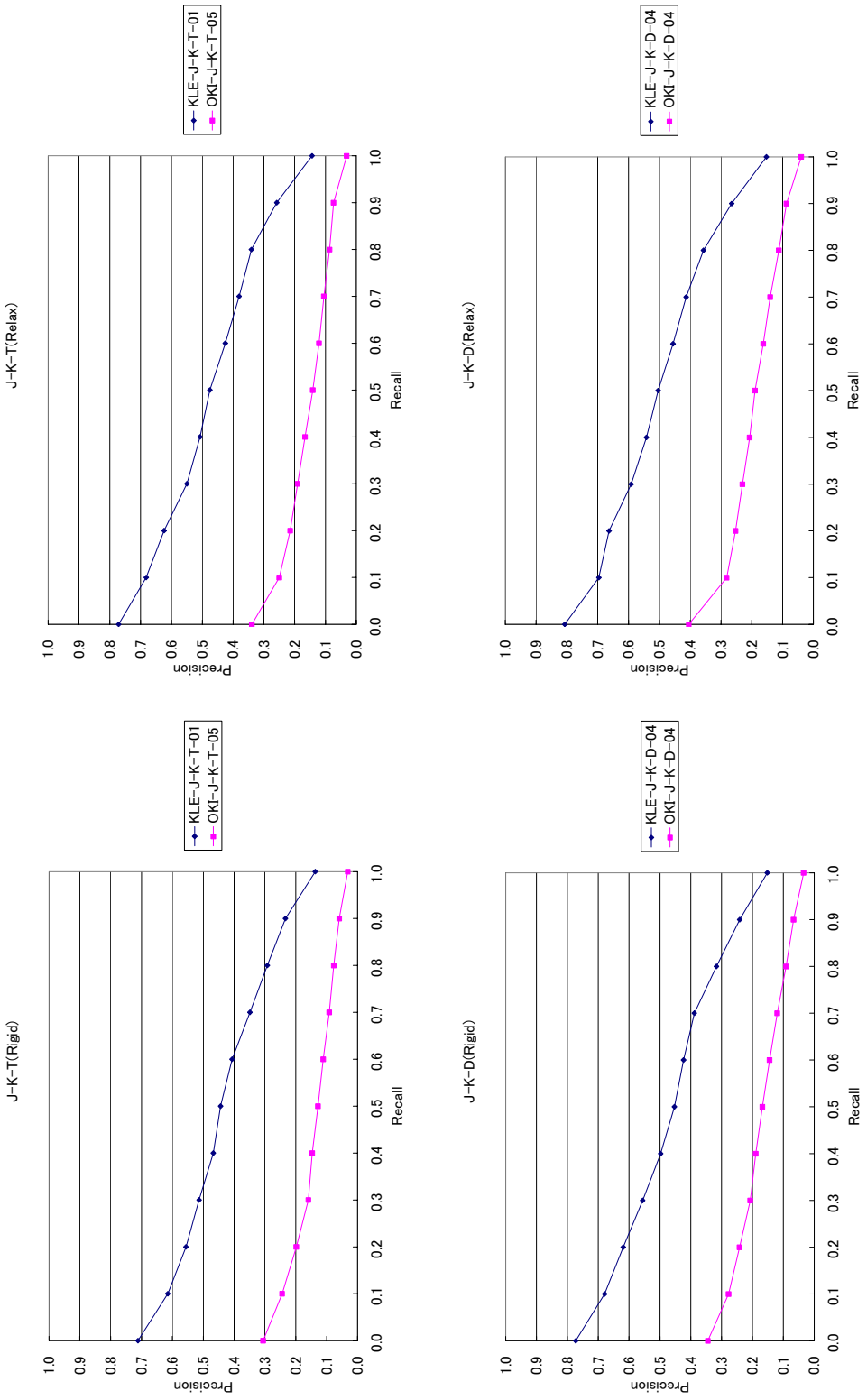
J-K-T(Relax)
J-K-D(Relax)
J-K-T(Rigid)
J-K-D(Rigid)
Precision
Recall
KLE-J-K-T-01
OKI-J-K-T-05
KLE-J-K-D-04
OKI-J-K-D-04
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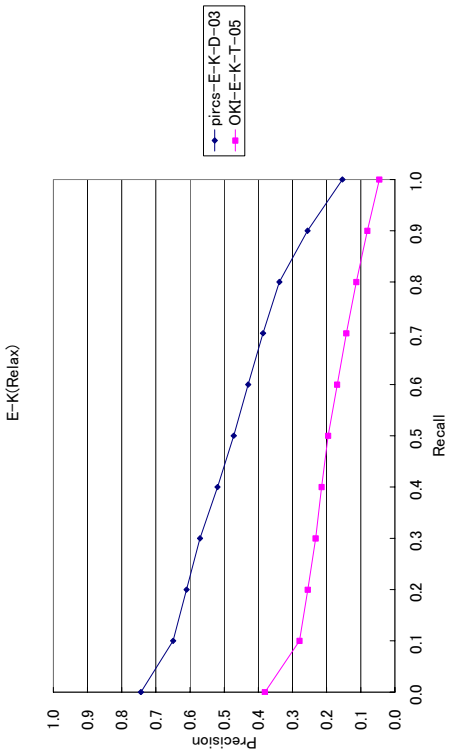
E-K(Relax)
pircs-E-K-D-03
OKI-E-K-T-05
Precision
Recall
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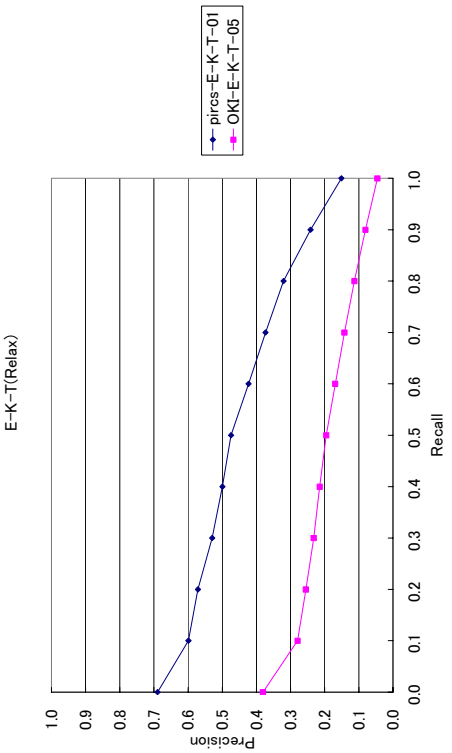
E-K-T(Relax)
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OKI-E-K-T-05
Precision
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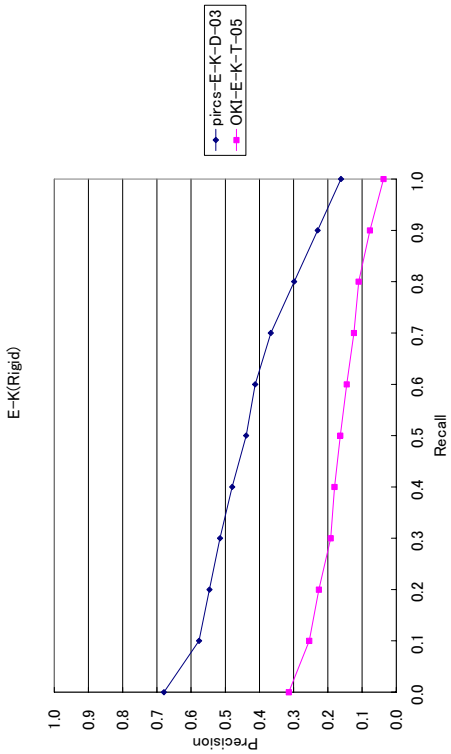
E-K(Rigid)
pircs-E-K-D-03
OKI-E-K-T-05
Precision
Recall
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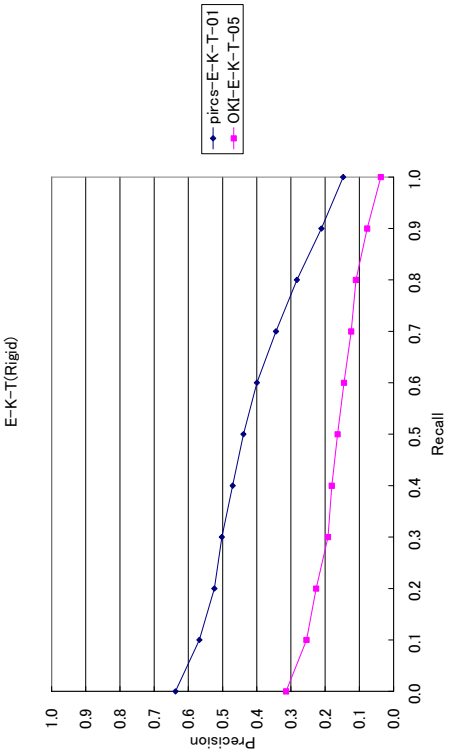
E-K-T(Rigid)
pircs-E-K-T-01
OKI-E-K-T-05
Precision
Recall
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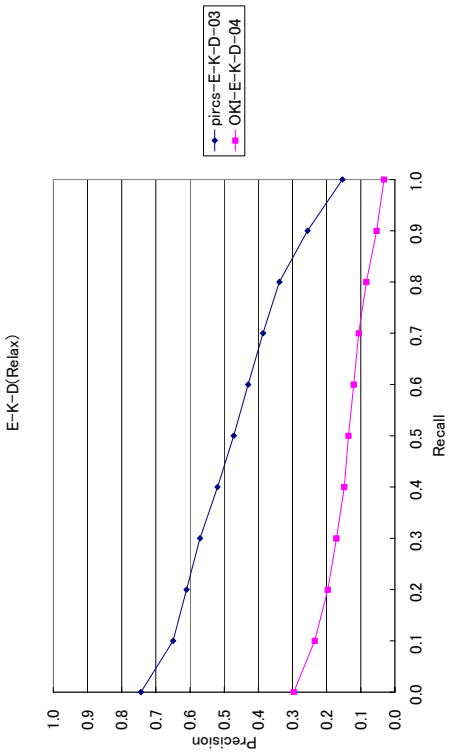
E-K-D(Relax)
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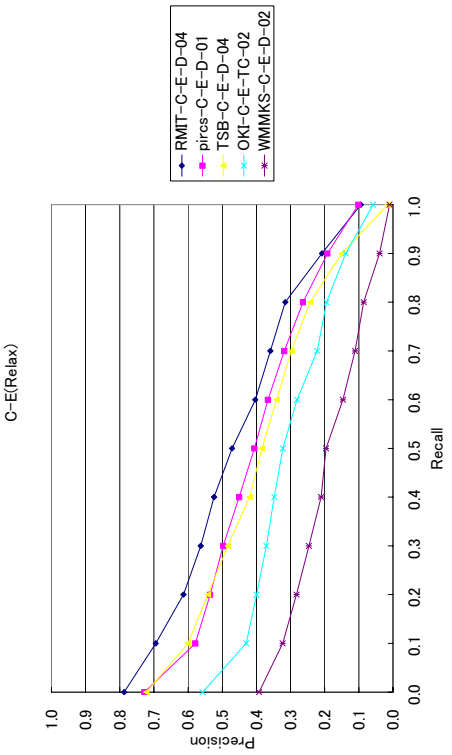
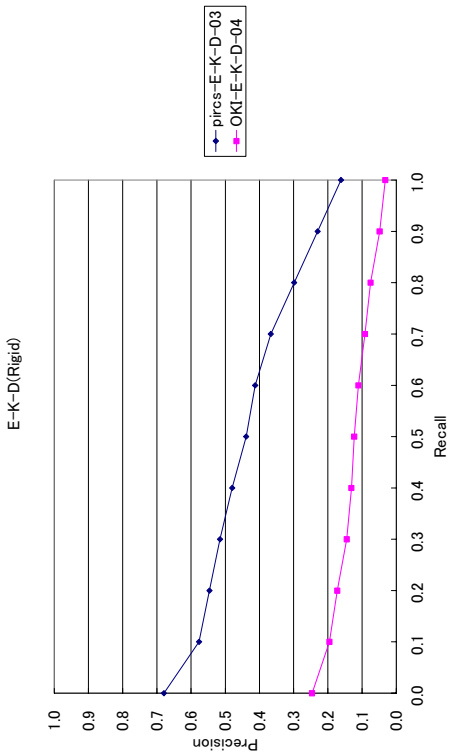
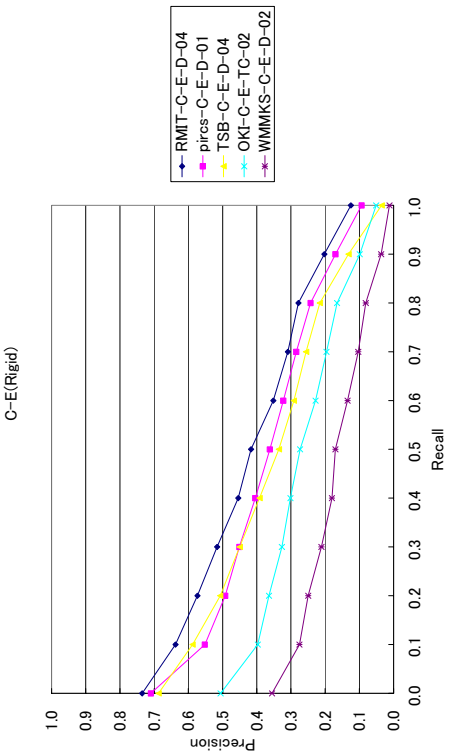
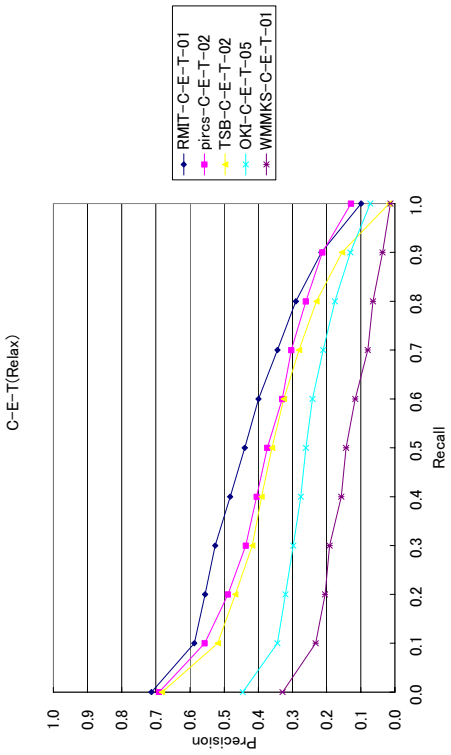
OKI-E-K-D-04
Precision
Recall


C-E(Relax)
RMIT-C-E-D-04
pircs-C-E-D-01
TSB-C-E-D-04
OKI-C-E-TC-02
WMMKS-C-E-D-02
Precision
Recall


E-K-D(Rigid)
pircs-E-K-D-03
OKI-E-K-D-04
Precision
Recall


C-E(Rigid)
RMIT-C-E-D-04
pircs-C-E-D-01
TSB-C-E-D-04
OKI-C-E-TC-02
WMMKS-C-E-D-02
Precision
Recall


C-E-T(Relax)
Precision
Recall
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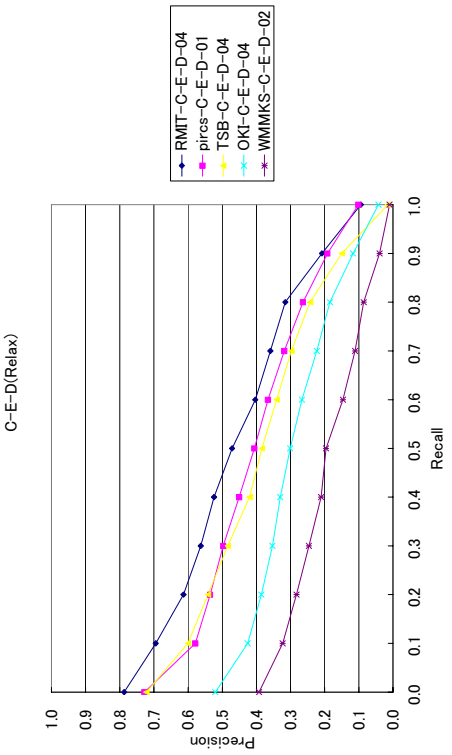
pircs-C-E-T-02
TSB-C-E-T-02
OKI-C-E-T-05
WMMKS-C-E-T-01


C-E-D(Relax)
Precision
Recall
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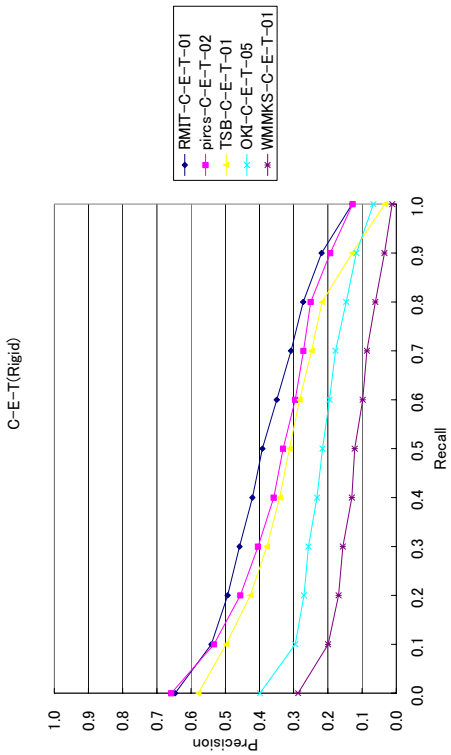
pircs-C-E-D-01
TSB-C-E-D-04
OKI-C-E-D-04
WMMKS-C-E-D-02


C-E-T(Rigid)
Precision
Recall
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pircs-C-E-T-02
TSB-C-E-T-01
OKI-C-E-T-05
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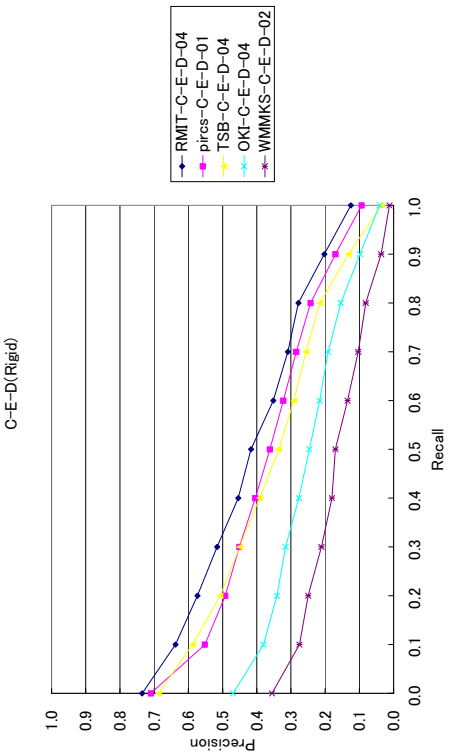
C-E-D(Rigid)
Precision
Recall
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pircs-C-E-D-01
TSB-C-E-D-04
OKI-C-E-D-04
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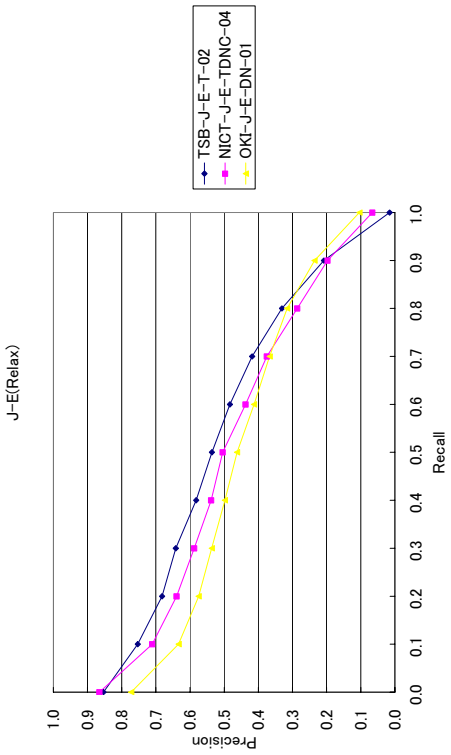
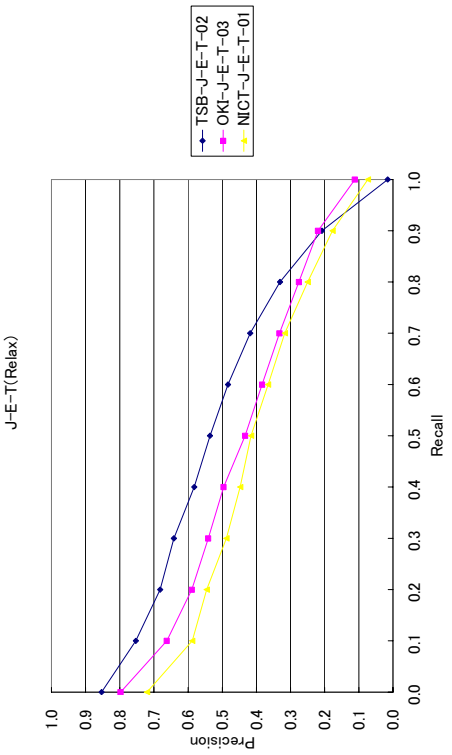
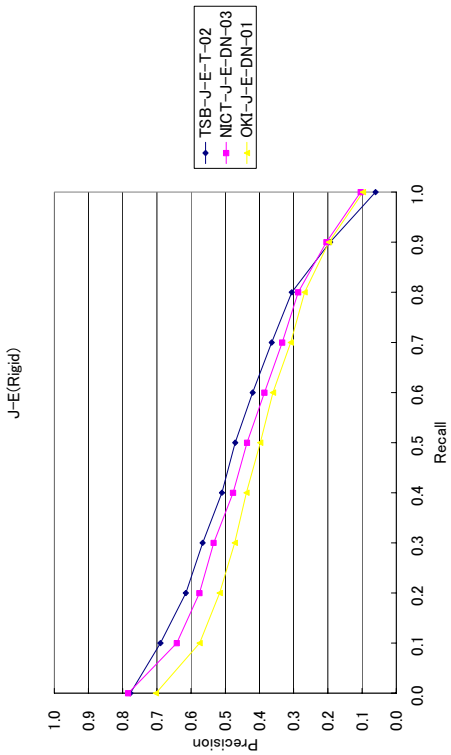
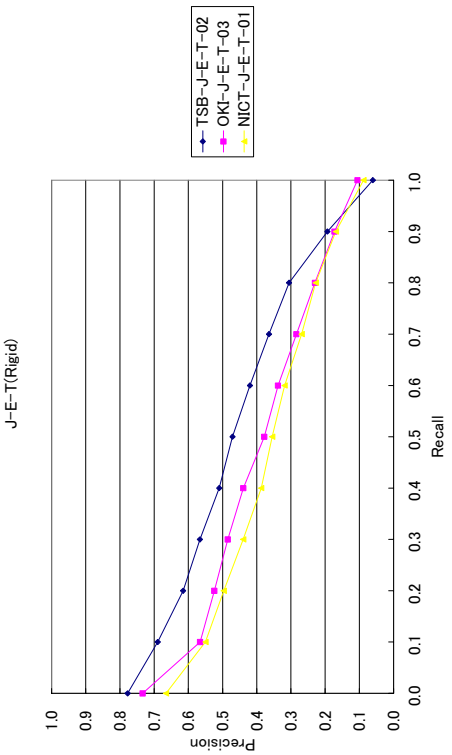
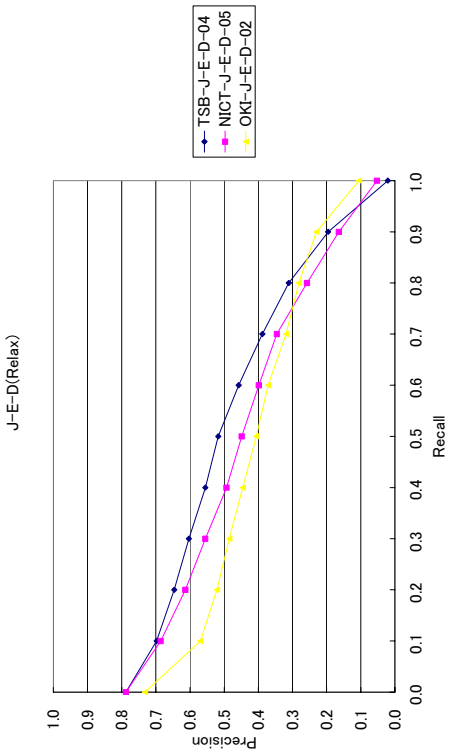
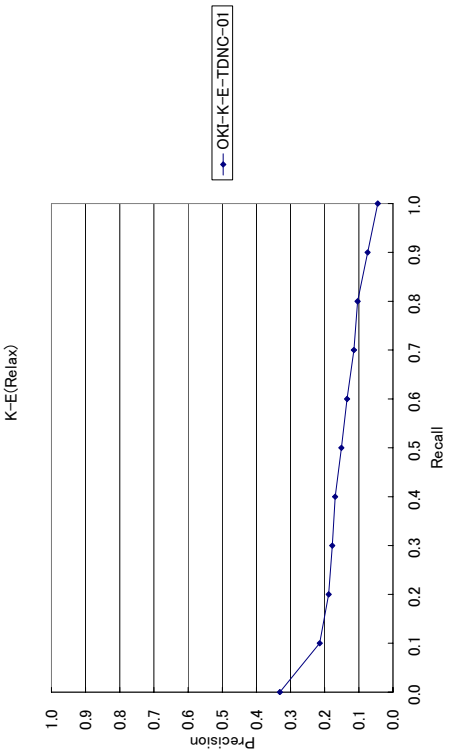

J-E(Relax)
TSB-J-E-T-02
NICT-J-E-TDNC-04
OKI-J-E-DN-01
Precision
Recall

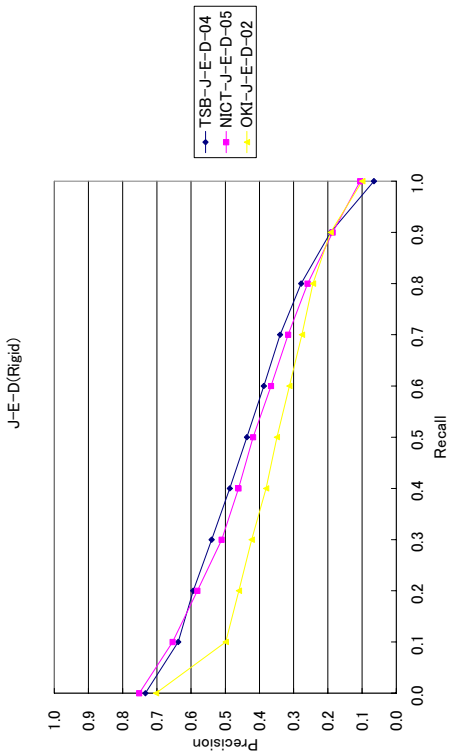

J-E-T(Relax)
TSB-J-E-T-02
OKI-J-E-T-03
NICT-J-E-T-01
Precision
Recall

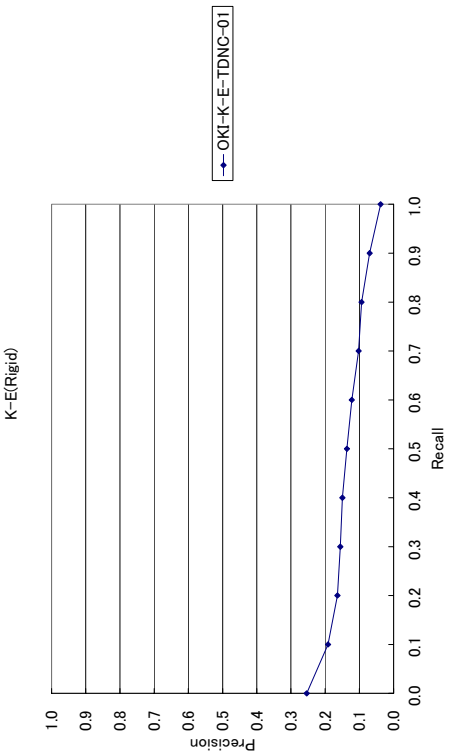

J-E(Rigid)
TSB-J-E-T-02
NICT-J-E-DN-03
OKI-J-E-DN-01
Precision
Recall

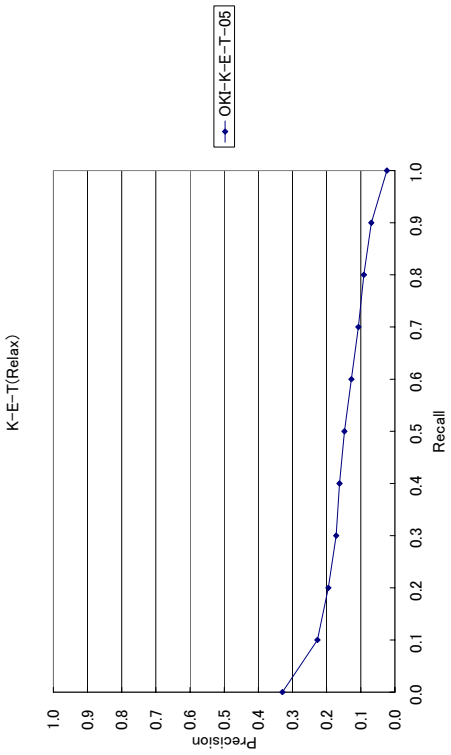

J-E-T(Rigid)
TSB-J-E-T-02
OKI-J-E-T-03
NICT-J-E-T-01
Precision
Recall

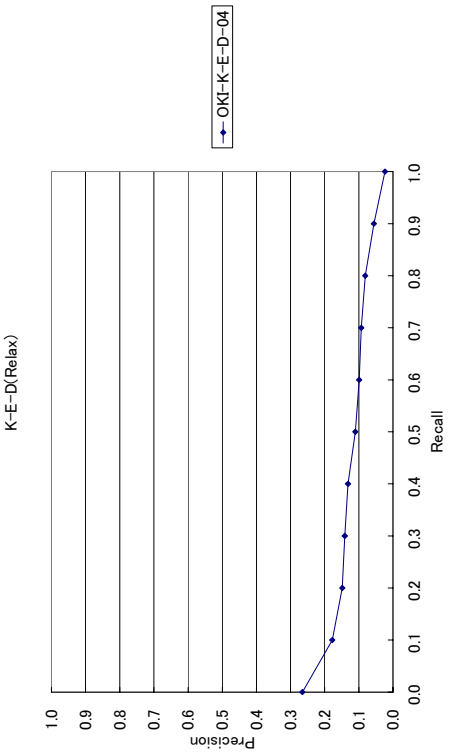

J-E-D(Relax)
TSB-J-E-D-04
NICT-J-E-D-05
OKI-J-E-D-02
Precision
Recall

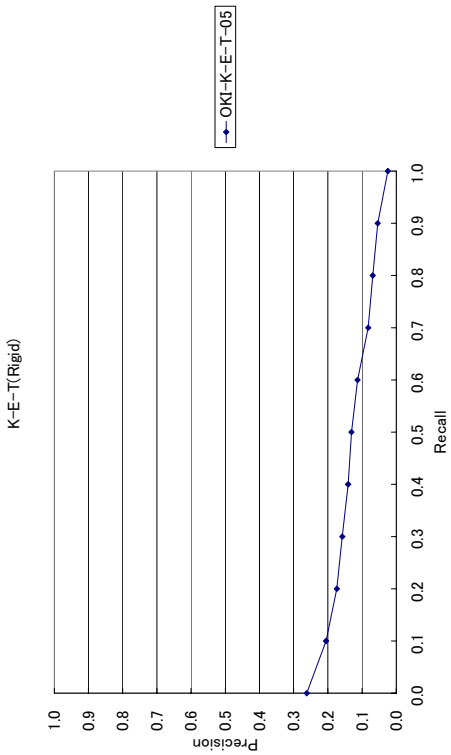

K-E(Relax)
OKI-K-E-TDNC-01
Precision
Recall

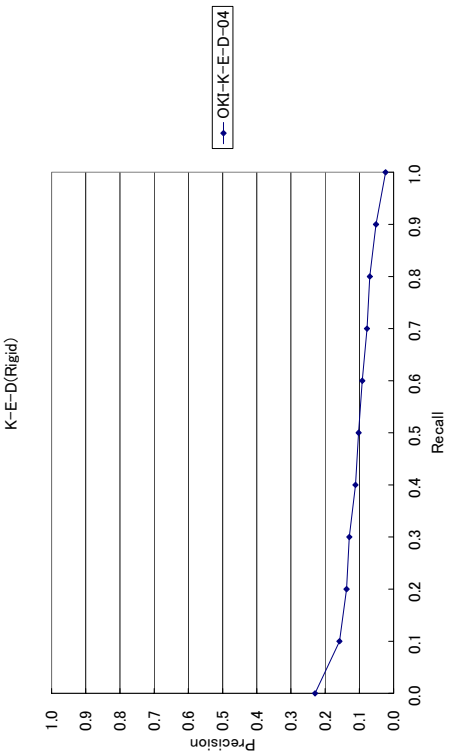

J-E-D(Rigid)
TSB-J-E-D-04
NICT-J-E-D-05
OKI-J-E-D-02
Precision
Recall

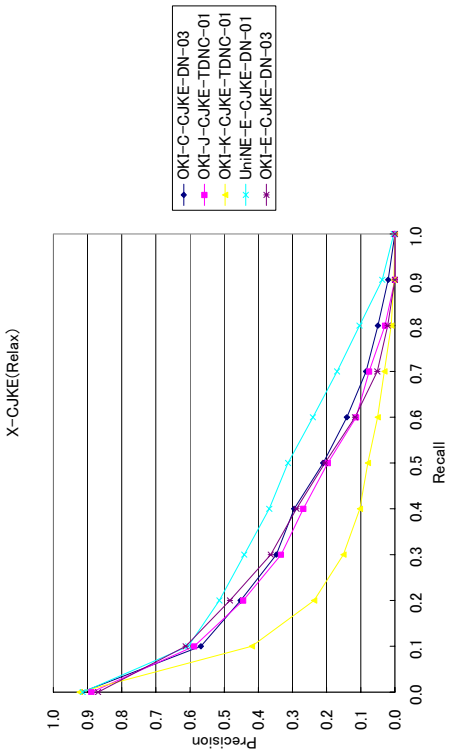

K-E(Rigid)
OKI-K-E-TDNC-01
Precision
Recall

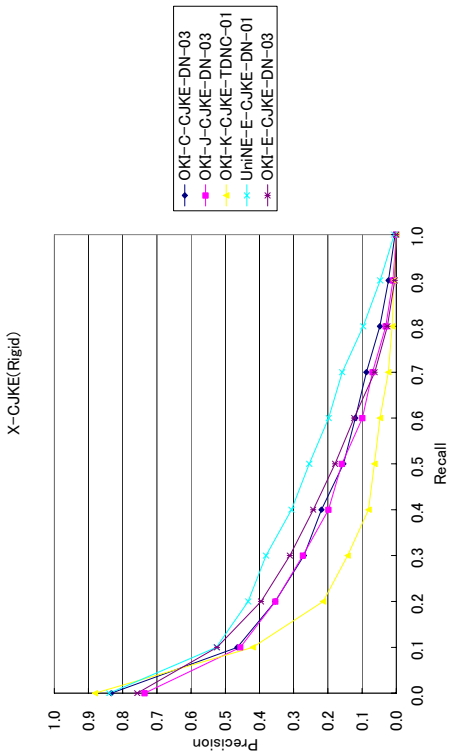

K-E-T(Relax)
OKI-K-E-T-05
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


K-E-D(Relax)
OKI-K-E-D-04
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


K-E-T(Rigid)
OKI-K-E-T-05
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


K-E-D(Rigid)
OKI-K-E-D-04
Precision
Recall
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


X-CJKE(Relax)
Precision
Recall
OKI-C-CJKE-DN-03
OKI-J-CJKE-TDNC-01
OKI-K-CJKE-TDNC-01
UniNE-E-CJKE-DN-01
OKI-E-CJKE-DN-03


X-CJKE(Rigid)
Precision
Recall
OKI-C-CJKE-DN-03
OKI-J-CJKE-DN-03
OKI-K-CJKE-TDNC-01
UniNE-E-CJKE-DN-01
OKI-E-CJKE-DN-03