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소프트웨어융합 종합학술대회

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제목: The Data Civilizer System

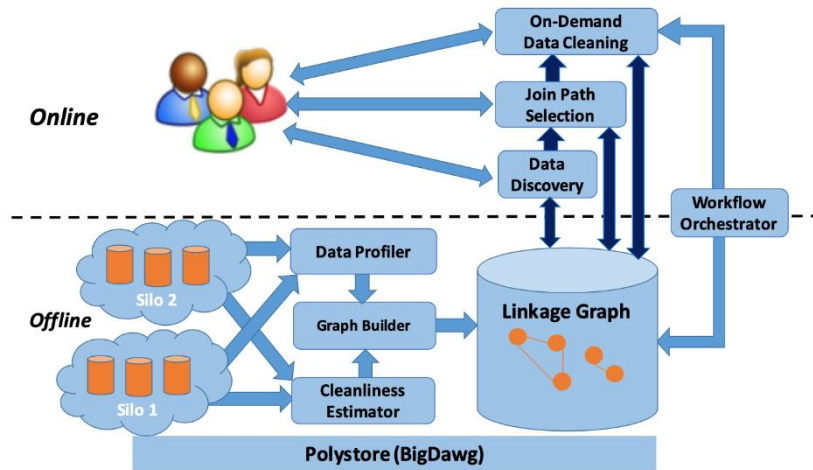
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The Data Civilizer System



end-to-end 빅데이터 관리 시스템

Linkage Graph

데이터에 대한
링크 그래프 구축

Discovery

링크 그래프를 활용하여
사용자 작업에 관련한 데이터 식별



- 링크 그래프를 사용하여 join path 찾기
- 실제 query 실행에서 polystore DBMS 사용
- 데이터 클리닝 작업을 query에 통합



Data preprocessing

- 결측치 제거

```
def cleanliness(df):  
    for x in df.columns:  
        df[x] = df[x].apply(lambda x: None if x == "null" else x)  
        if 'int64' == df[x].dtype:  
            lis = list(df[x])  
            for i in range(len(lis)):  
                df = validate(x, df, lis[i])  
            IQR(df, x, lis)  
    return df
```

- Outlier 제거

```
def validate(x, df, date):  
    try:  
        datetime.datetime.strptime(str(date), '%Y%m%d')  
    except ValueError:  
        df[x] = df[x].replace(date, np.nan)  
    return df
```

- 날짜 데이터 유효성 검사

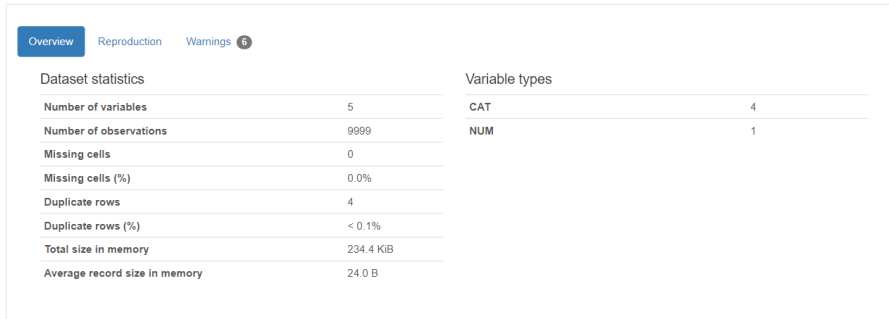
```
def IQR(df, x, lis):  
    Q1 = df.quantile(.25)  
    Q3 = df.quantile(.75)  
    IQR = Q3 - Q1  
    for i in range(len(lis)):  
        if ((df[x] < (Q1 - 1.5 * IQR)) | (df[x] > (Q3 + 1.5 * IQR))):  
            df[x] = df[x].replace(lis[i], np.nan)  
    return df
```



Data Profiling : pipeline 구조

- pandas_profiling 라이브러리를 사용하여 profiling진행 및 메타 데이터 추출

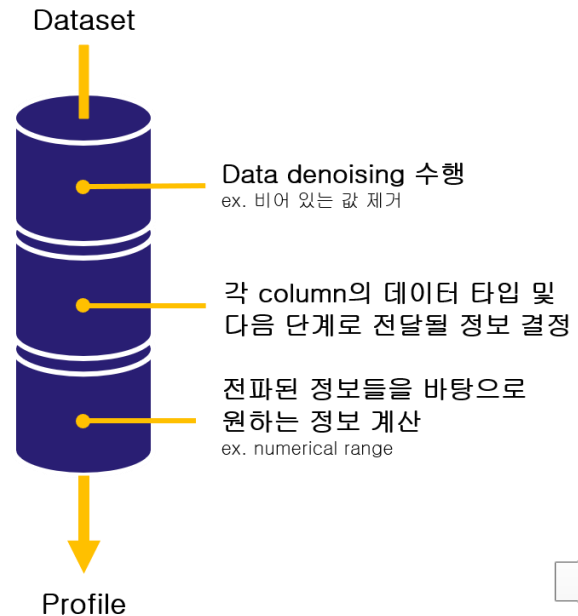
Overview



- 칼럼 간 유사성 및 inclusion dependency 계산 구현

```
def col_similarity(table1, table2):
    res = {}
    col_sim = []
    ind = []
    for x in table1:
        for z in table2:
            top = 0
            dict(x[3])
            dict(z[3])
            top_key = x[3].keys()
            bottom_key = z[3].keys()
            for y in top_key:
                if y in bottom_key:
                    top += min(int(x[3][y]), int(z[3][y]))
            bottom = int(x[1]) + int(z[1]) - top # column1 + column2 - (col1과 col2의 교집합)
            if (top != 0 and bottom != 0):
                col_sim += [[x[0], z[0], float(top / bottom)]]
    if (len(col_sim) != 0):
        res['column_similarity'] = col_sim
    return res

def inclusion_dependency(table1, table2):
    res = {}
    ind = []
    for x in table1:
        for z in table2:
            dict(x[3])
            dict(z[3])
            top_key = x[3].keys()
            bottom_key = z[3].keys()
            if len(set(top_key) & set(bottom_key)) != 0:
                IND = float(
                    len(set(top_key) & set(bottom_key)) / len(set(top_key))) ## col_name의 교집합 / x의 집합 == 1일 경우 IND 설정
                if IND == 1:
                    ind += [[x[0], z[0], 'IND']]
    if (len(ind) != 0):
        res['inclusion_dependency'] = ind
    return res
```



Data Update

- 데이터베이스 쿼리로그를 읽어와서 업데이트가 된 테이블에 대하여 프로파일링 재진행
- 기존 프로파일링과 비교하여 바뀐 사항 업데이트

DB의 query log

```
SELECT * FROM mysql.general_log ORDER BY event_time DESC LIMIT 5;
```

event_time	user_host	thread_id	server_id	command_type	argument
2020-09-06 00:11:43.867121	root[root] @ localhost [::1]	8	1	Query	SELECT * from mysql.general_log
2020-09-06 00:12:33.792293	[root] @ localhost [::1]	9	1	Connect	root@localhost as anonymous on capstone
2020-09-06 00:12:33.795262	root[root] @ localhost [::1]	9	1	Query	SET AUTOCOMMIT = 0
2020-09-06 00:12:33.795886	root[root] @ localhost [::1]	9	1	Query	SHOW TABLES
2020-09-06 00:12:33.798075	root[root] @ localhost [::1]	9	1	Query	DROP TABLE test1

저장되어 있는 마지막 쿼리문의 시간보다 최근의 쿼리문만 모두 불러오기

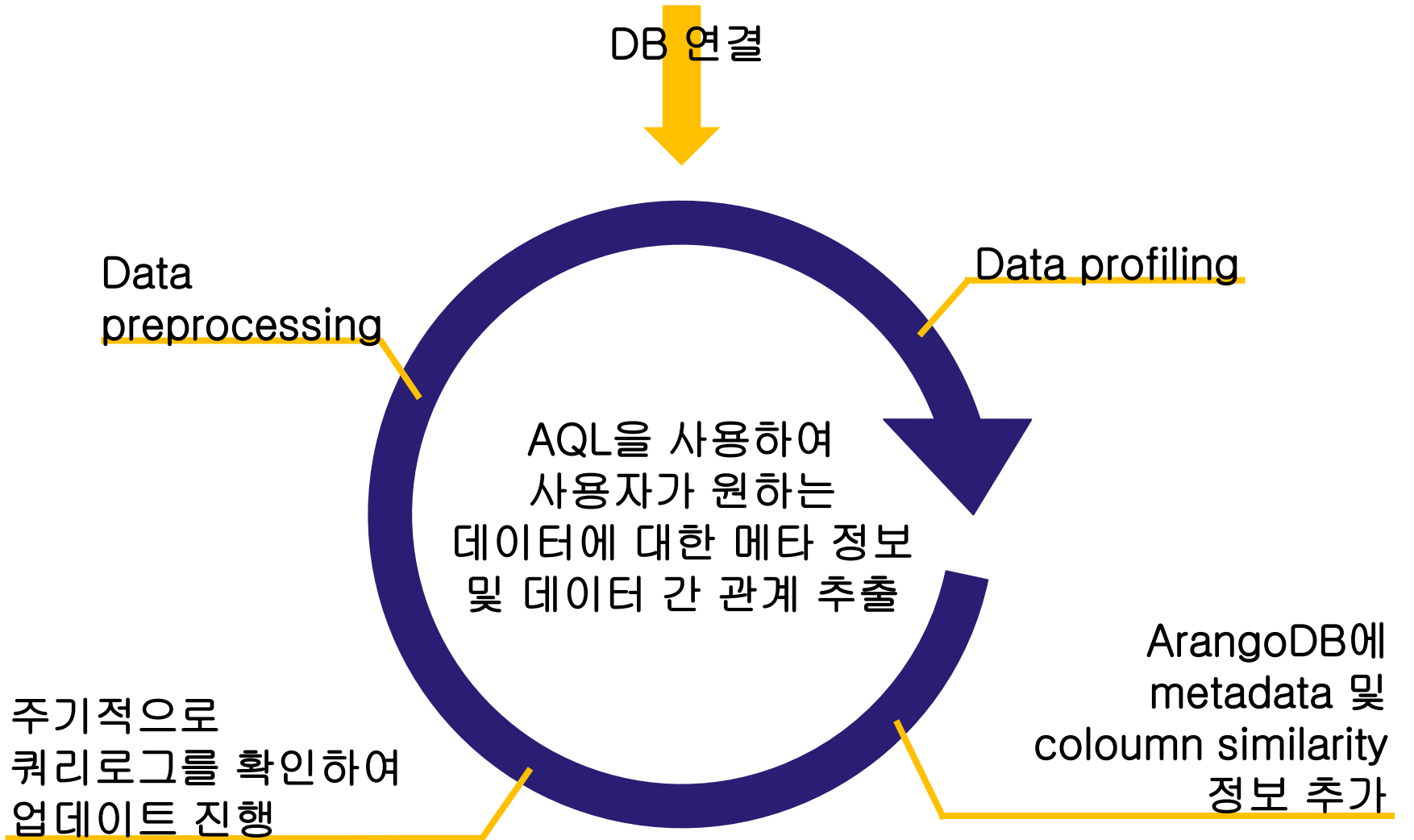
```
SELECT *  
FROM mysql.general_log  
WHERE event_time > '2020-09-06 00:14:55'  
ORDER BY event_time DESC;
```

```
INSERT INTO test3 (Name, Classification, Type)  
VALUES ('07WK35D12900', '절토사면', '도로사면')
```

불러온 쿼리문에서 테이블명 추출
-> profile 진행



Data Civilizer System Structure



Data Civilizer 구현 결과

- ArangoDB에 테이블의 메타데이터 입력

```
_id: test1/Classification
_rev: _bKpAJza---
_key: Classification
```

Select a node...

```
object {6}
  name: Classification
  value_counts: {'건축물': '9442', '교량': '4916', '하천': '1082', '터'
  type: Variable.TYPE_CAT
  max_length: 4
  mean_length: 2.595479968040178
  min_length: 1
```

```
_id: test2/End_date
_rev: _bLlgfUG---
_key: End_date
```

Select a node...

```
object {7}
  name: End_date
  value_counts: {'20190223': '1863', '20190630': '962', '20191230': '299', '20190531': '186', '20191201': '179', '20190930': '170', '20190930': '170', '20191227': '151', '20191201': '150', '20190622': '55', '20191228': '54', '20190731': '54', '20190801': '42', '20191221': '40', '20190131': '38', '20191231': '38', '20191216': '32', '20190225': '32', '20190629': '32', '20190901': '32', '20190604': '28', '20191011': '28', '20190801': '28', '20190529': '28', '20190515': '26', '20191110': '26', '20190615': '25', '20190520': '25', '20190604': '22', '20190117': '22', '20190130': '22', '20191201': '21', '20190322': '19', '20190511': '19', '20190415': '19', '20191231': '19', '20191211': '16', '20190719': '16', '20190807': '16', '20191010': '16', '20191001': '16', '20191116': '16', '20190722': '16', '20190511': '16', '20190424': '12', '20191109': '12', '20190401': '12', '20191024': '12', '20191209': '11', '20190411': '11', '20190921': '11', '20190901': '11', '20190518': '10', '20190616': '10', '20190427': '10', '20191104': '10', '20190623': '9', '20191225': '8', '20190828': '8', '20191221': '8', '20190603': '7', '20190325': '7', '20190430': '7', '20190821': '7', '20190918': '6', '20190426': '6', '20190822': '6', '20191111': '6', '20190131': '6', '20190405': '6', '20191005': '5', '20190803': '5', '20190810': '5', '20190514': '5', '20190222': '5', '20190611': '5', '20190805': '4', '20190802': '4', '20191007': '4', '20190808': '4', '20190807': '3', '20190117': '3', '20190409': '3', '20190227': '3', '20190805': '3', '20190810': '3', '20190701': '2', '20190602': '2', '20190508': '2', '20190227': '2', '20190812': '2', '20190824': '2', '20190908': '2', '20190227': '2', '20190514': '1', '20190507': '1', '20190420': '1', '20190512': '1', '20190826': '1', '20191008': '1', '20190811': '1', '20190728': '1', '20190726': '1', '20191006': '1', '20190928': '1', '20190711': '1'}
```

Select a node...

```
type: Variable.TYPE_NUM
max: 20191231
min: 20190101
mean: 20190807.760920153
range: 1330
```

```
_id: test1/test1
_rev: _bKpAJzy----
_key: test1
```

Select a node...

```
object {3}
  n: 17522
  missing: 1
  columns: [3]
    0: Name
    1: Classification
    2: Location
    3: Completion_Date
    4: Type
```

- 칼럼간 유사성 및 inclusion dependency 데이터 입력

```
_id: relation/coltest3.NameAndtest1.Name
_rev: _bKpAleG---
_key: coltest3.NameAndtest1.Name
```

Select a node...

```
object {2}
  type: column_similarity
  value: 0.10333844237953826
```

```
_id: relation/INDtest3.ClassificationAndtest2.Classification
_rev: _bLlgQ8----
_key: INDtest3.ClassificationAndtest2.Classification
```

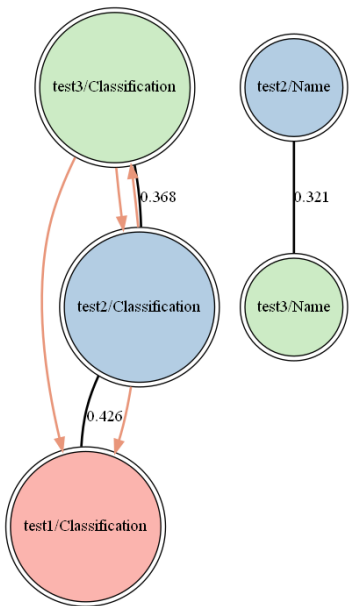
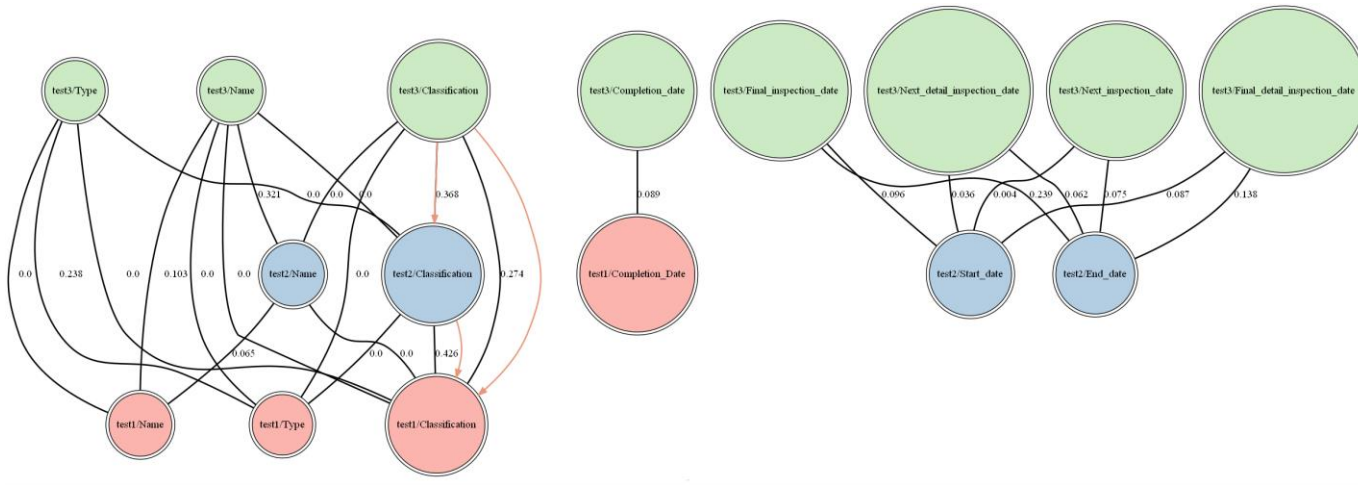
Select a node...

```
object {2}
  type: inclusion_dependency
  value: 1
```



Data Civilizer 구현 결과

FOR x IN relation RETURN x



FOR x IN relation FILTER x.value > 0.3 RETURN x

