

# [문서 파일 키워드 추출 및 시각화]

## 프로젝트 목표

- 한글, 워드, pdf, 엑셀 문서들에서 중요하다고 판단되는 키워드들을 추출
- 키워드 추출 후 각 키워드와 관련 있는 키워드들로 시각화

## 프로젝트 기획 배경

2022년도 상반기에 6G 동향에 관한 논문을 쓰려다가 논문들을 수집하게 되었다. 수집후 분류를 하려고 하는데 어떻게 분류해야 좋을지에 대하여 생각 하던 중 여러 논문들에서 키워드들을 추출해주는 프로그램이 있었으면 좋겠다고 생각하여 제작하게 됨

## 프로젝트 목차

1. 데이터 읽기 및 전처리: hwp, docx, pdf 파일을 읽고 okt로 전처리
2. 머신러닝 모델 학습: lda, coherence 모델을 통해 키워드 추출
  - 2.1 모델에 필요한 데이터 생성
  - 2.2 모델 학습
3. 시각화: 학습된 모델을 바탕으로 시각화
  - 3.1 wordcloud로 시각화
  - 3.2 pyLDAvis를 통한 html로 시각화

## 프로젝트 개요

인간이 하나의 문서의 키워드를 뽑아낼 때는 하나의 문서를 읽을 시간과 그 문서를 이해할 지식이 필요합니다. 1개의 문서에서 키워드들을 뽑아내는것은 쉬워 보일 수 있다. 하지만 1개의 문서가 아니라 공통 주제를 가지고 있는 여러개의 문서에서 키워드들을 뽑아내기 위해서는 시간이 많이 걸릴 것으로 예상된다.

이번 프로젝트에서는 문서 확장자(hwp, docx, pdf)를 가진 한국어문서를 대상으로 키워드를 추출하고 시각화할것이다. 이 프로젝트는 한 분야의 논문들의 키워드 추출이나, 원하는 곳의 자소서들의 키워드를 추출하는등 다양하게 활용될것으로 보이며 여기에서는 논문들의 키워드 추출을 목표로 프로젝트를 진행할 것이다.

## 데이터 출처 (science on)

자율 주행 자동차 보안 위협 및 기술 동향 논문

<https://scienceon.kisti.re.kr/srch/selectPORSrchArticle.do?cn=JAKO202013965595400>

자율주행 자동차 기술 동향(Technology Trends of Self-Driving Vehicles) 논문

<https://scienceon.kisti.re.kr/srch/selectPORSrchArticle.do?cn=JAKO201352057196956>

```
In [1]: import os
dir_path = "C:\\Users\\kimdaehan\\Documents\\data" # 논문이 들어 있는 폴더
print(os.listdir(dir_path))

['자율주행자동차기술동향.pdf', '자율주행자동차보안위협및기술동향.pdf']
```

## 1. 데이터 읽기 및 전처리

olefile, docx2txt, PyPDF2로 각각 hwp, docx, pdf파일을 읽어온다. 그후 한글 및 영어만 남게 다 삭제한뒤 okt로 불용어를 삭제하고 명사만 가져온다.

```
In [2]: import os
def main():
    dir_path = "C:\\Users\\kimdaehan\\Documents\\data" # 논문이 들어 있는 폴더
```

```

file_list = os.listdir(dir_path) # 파일 이름 가져오기
words = [] #단어들이 들어갈 배열
for file in file_list:
    file_path = dir_path + "\\\" + file
    if file.split('.')[1] == 'pdf':
        words += getPdfWord(file_path)
    elif file.split('.')[1] == 'hwp':
        words += getHwpWord(file_path)
    elif file.split('.')[1] == 'docx':
        words += getDocxWord(file_path)
    else:
        print('확장자 오류')

```

문서내 텍스트가 콤마(,)로 끝났어도 '\n'이 아니라 띄어쓰기로 끝나는 경우 띄어쓰기 하는 함수 선언

```

In [3]: def addEnter(text):
        text = text + ' '
        new_text = ''
        for i in range(len(text)-1):
            if text[i] == '.' and text[i+1] != '\n': # 콤마(.) 뒤에 \n이 없을 경우 추가
                new_text += '.\n'
            else:
                new_text += text[i]
        return new_text

```

hwp의 경우

```

In [4]: def getHwpWord(file_path):
        okt = Okt()
        result = []
        f = olefile.OleFileIO(file_path) # hwp 파일을 가져오기 위해 olefile을 사용
        encoded_text = f.openstream('PrvText').read()
        decoded_text = encoded_text.decode('UTF-16')
        decoded_text = addEnter(decoded_text)
        for line in decoded_text.split('\n'):
            line = re.sub(r"[\uAC00-\uD7A3a-zA-Z\s]", "", line)
            nouns = okt.nouns(line)
            if nouns != []:
                temp = []
                for i in nouns: #2글자 이상 부터 유의미한 단어가 많음 > 1글자 시 맞, 자, 등등 필요없는 단어 추출됨
                    if len(i) >= 2:
                        temp.append(i)
                if temp != []:
                    result.append(temp) # 명사들만 넣기
        return result

```

docx의 경우

```

In [5]: def getDocxWord(file_path):
        okt = Okt()
        result = []
        text = docx2txt.process(file_path).rstrip() # docx 파일을 가져오기 위해 docx2txt를 사용
        text = addEnter(text).split('\n')
        for line in text:
            line = re.sub(r"[\uAC00-\uD7A30-9a-zA-Z\s]", "", line)
            nouns = okt.nouns(line)
            if nouns != []:
                temp = []
                for i in nouns: #2글자 이상 부터 유의미한 단어가 많음 > 1글자 시 맞, 자, 등등 필요없는 단어 추출됨
                    if len(i) >= 2:
                        temp.append(i)
                if temp != []:
                    result.append(temp) # 명사들만 넣기
        return result

```

pdf의 경우

```

In [6]: def getPdfWord(file_path):
        okt = Okt()
        result = []
        pdf = PdfFileReader(open(file_path, 'rb')) # pdf 파일 읽어오기

        for i in range(len(pdf.pages)):
            page = pdf.pages[i].extractText() #페이지마다 문자 추출
            page = addEnter(page) # 콤마(.) 뒤에 \n 추가
            page = re.sub(r"[\uAC00-\uD7A3a-zA-Z\s]", "", page) # 특수문자 및 숫자 제거
            lines = page.split('\n')
            for line in lines:
                nouns = okt.nouns(line) #불용어 제거
                if nouns != []:
                    temp = []
                    for i in nouns: #2글자 이상 부터 유의미한 단어가 많음 > 1글자 시 맞, 자, 등등 필요없는 단어 추출됨
                        if len(i) >= 2:
                            temp.append(i)

```

```

        if temp != []:
            result.append(temp) # 명사들만 넣기
    return result

```

위의 코드들을 합쳐서 사용

```

In [7]: import os
import re
import docx2txt
import olefile

from PyPDF2 import PdfFileReader
from konlpy.tag import Okt

dir_path = "C:\\Users\\kimdaehan\\Documents\\data" # 논문이 들어 있는 폴더
file_list = os.listdir(dir_path) # 파일 이름 가져오기
words = [] #단어들이 들어갈 배열

def addEnter(text):
    text = text + ' '
    new_text = ''
    for i in range(len(text)-1):
        if text[i] == '.' and text[i+1] != '\\n':
            new_text += '.\\n'
        else:
            new_text += text[i]
    return new_text

def getDocxWord(file_path):
    okt = Okt()
    result = []
    text = docx2txt.process(file_path).rstrip()
    text = addEnter(text).split('\\n')
    for line in text:
        line = re.sub(r"[^\\uAC00-\\uD7A30-9a-zA-Z\\s]", "", line)
        nouns = okt.nouns(line)
        if nouns != []:
            temp = []
            for i in nouns: #2글자 이상 부터 유의미한 단어가 많음 > 1글자 시 및, 자, 등등 필요없는 단어 추출됨
                if len(i) >= 2:
                    temp.append(i)
            if temp != []:
                result.append(temp) # 명사들만 넣기

    return result

def getHwpWord(file_path):
    okt = Okt()
    result = []
    f = olefile.OleFileIO(file_path)
    encoded_text = f.openstream('PrvText').read()
    decoded_text = encoded_text.decode('UTF-16')
    decoded_text = addEnter(decoded_text)
    for line in decoded_text.split('\\n'):
        line = re.sub(r"[^\\uAC00-\\uD7A3a-zA-Z\\s]", "", line)
        nouns = okt.nouns(line)
        if nouns != []:
            temp = []
            for i in nouns: #2글자 이상 부터 유의미한 단어가 많음 > 1글자 시 및, 자, 등등 필요없는 단어 추출됨
                if len(i) >= 2:
                    temp.append(i)
            if temp != []:
                result.append(temp) # 명사들만 넣기
    return result

def getPdfWord(file_path):
    okt = Okt()
    result = []
    pdf = PdfFileReader(open(file_path, 'rb')) # pdf 파일 읽어오기

    for i in range(len(pdf.pages)):
        page = pdf.pages[i].extractText() #페이지마다 문자 추출
        page = addEnter(page) # 콤마(.) 뒤에 \\n 추가
        page = re.sub(r"[^\\uAC00-\\uD7A3a-zA-Z\\s]", "", page) # 특수문자 및 숫자 제거
        lines = page.split('\\n')
        for line in lines:
            nouns = okt.nouns(line) #불용어 제거
            if nouns != []:
                temp = []
                for i in nouns: #2글자 이상 부터 유의미한 단어가 많음 > 1글자 시 및, 자, 등등 필요없는 단어 추출됨
                    if len(i) >= 2:
                        temp.append(i)
                if temp != []:
                    result.append(temp) # 명사들만 넣기
    return result

# 확장자 별로 각 함수를 적용하여 단어를 추출해옴

```

```

for file in file_list:
    file_path = dir_path + "\\\" + file
    if file.split('.')[1] == 'pdf':
        words += getPdfWord(file_path)
    elif file.split('.')[1] == 'hwp':
        words += getHwpWord(file_path)
    elif file.split('.')[1] == 'docx':
        words += getDocxWord(file_path)
    else:
        print('확장자 오류')

```

```

print(words)

```

[['한국', '전자통신', '연구원'], ['과거', '드라마', '인기', '전격', '작전', '키트', '우리', '자율', '주행', '자동차'], ['환상'], ['자율', '주행', '자동차', '이제', '현실'], ['자율', '주행', '자동차', '대한', '정의', '운전자', '개인', '주변', '환경', '인식', '주행', '상황', '판단', '차량', '제어', '스스로', '목적지', '주행', '자동차'], ['자율', '주행', '자동차', '교통사고', '교통', '효율', '높이', '연료', '절감', '운전', '대신', '편의', '증대', '미래', '개인', '교통', '수단', '기대'], ['자율', '주행', '자동차', '기술', '구성', '요소', '관련', '기술', '개발', '동향', '대해', '기술', '자율', '주행', '자동차', '실제', '적용', '위해', '법적', '문제', '향후', '전망', '대해'], ['자율', '주행', '자동차', '자율', '주행', '기술'], ['융합', '기술', '특집'], ['서론'], ['자율', '주행', '기술', '개요'], ['자율', '주행', '자동차'], ['개발', '동향'], ['제도', '문제'], ['결론'], ['안경환'], ['자율', '주행', '시스템', '연구실', '선임', '연구원'], ['이상우'], ['자율', '주행', '시스템', '연구실', '선임', '연구원'], ['자율', '주행', '시스템', '연구실', '실장'], ['산업', '융합', '구단', '단장'], ['연구', '지식경제부', '한국', '산업', '기술', '평가', '관리원', '사업', '일환', '수행'], ['기반', '차량', '운전자', '협력', '자율', '주행', '시스템', '판단', '제어', '기술', '개발'], ['전자통신', '동향', '분석', '제호'], ['서론'], ['주말', '연휴', 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'규격'], ['자동차', '표준'], ['프라이버시', '보존', '자동차', '표준'], ['기반', '보안', '플랫폼', '규격'], ['자동차', '전용', '임베디드', '소프트웨어'], ['표준'], ['버전', '이후', '보안', '규격', '포함'], ['자동차', '통한', '진단', '표준'], ['통합', '진단'], ['센서', '레이어', '서비스'], ['네트워크', '통합', '진단'], ['네트워크', '통한', '진단'], ['자동차', '진단', '프로토콜', '표준'], ['확장', '자동차', '차량', '클라우드'], ['서비스', '인터페이스', '표준'], ['보안', '규격', '포함'], ['보안', '제어', '기능', '자동차'], ['소프트웨어', '업데이트', '절차'], ['차량', '통신', '시스템', '스istem', '보안'], ['권고', '사항'], ['차량', '접속', '디바이스', '보안', '요구사항'], ['차량', '침입', '탐지', '시스템', '구성', '방법'], ['차량', '클라우드', '엣지', '컴퓨팅', '보안'], ['권고', '사항'], ['를위', '보안', '표준'], ['보안', '구조', '서비스'], ['보안취약점', '위협', '분석'], ['프라이버시', '보호', '기술'], ['접근제어', '기술'], ['보안', '구조', '서비스', '자율', '주행', '자동차', '관련', '보안', '기술표준'], ['자율', '주행', '자동차', '보안', '기술', '동향'], ['통해', '확인', '자율', '주행', '자동차'], ['탐재', '센서', '통신', '외부', '네트워크'], ['공격', '보안', '위협', '진입', '제공'], ['확인'], ['자율', '주행', '자동차', '발전'], ['성능', '고도화', '추세'], ['현재'], ['보안', '기술', '의비', '회발'], ['모리', '저장', '펌웨어', 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, '부트', '소프트웨어', '업데이트', '할경', '우해'], ['자율', '주행', '자동차', '보안', '위협', '기술', '동향'], ['소프트웨어', '조사', '해인', '소프트웨어'], ['확인', '어플', '접근제어'], ['기술', '보안', '업데이트', '위해'], ['서도', '사용'], ['국내외', '보안', '기술'], ['다음', '표율', '통해'], ['자율', '주행', '자동차', '관련', '보안', '기술표준', '내용', '확인'], ['결론'], ['자율', '주행', '자동차', '시장', '매년', '증가', '교통'], ['사고', '감소', '운전', '접근성', '차량', '운행'], ['업무', '가능', '장점', '매년', '확대', '추세'], ['자동차', '회사', '기업', '또한', '자율'], ['주행', '자동차', '상용', '대중', '연구', '개발'], ['진행중'], ['논문', '지속', '개발'], ['자율', '주행', '자동차', '기술', '동향', '파악', '자율'], ['주행', '자동차', '발생', '보안', '위협', '보안', '위해', '연구개발'], ['보안', '기술', '동향', '확인'], ['논문'], ['이자율', '주행', '자동차', '보안', '위협', '지속'], ['보안', '위협', '보안', '기술', '지속'], ['연구', '추세'], ['자율', '주행', '자동차', '의경'], ['오류로', '물리', '피해', '인간'], ['피해', '때문', '상용', '대중'], ['위해', '지속', '보안', '기술', '연구', '적용', '실증'], ['테스트'], ['참고문헌'], ['접속'], ['서화', '권용빈', '법학', '안규환'], ['자율'], ['자동차', '보안', '동향'], ['정보보호', '학회'], ['자율', '주행', '자동차', '상용', '지원', '법률'], ['년월'], ['접속'], ['년월', '접속'], ['은비', '김휘강'], ['자율', '주행', '차량', '시스'], ['관점', '공격', '시나리오', '도출', '응방', '안연'], ['한국', '자동차', '학회', '논문'], ['자율', '주행', '기술', '단계'], ['년월', '접속'], ['자율', '주행', '핵심', '정밀', '지도'], ['년월', '접속'], ['호기', '서재'], ['센서', '융합', '자동', '차용', '정밀'], ['시스템'], ['오토'], ['권혁', '이석준', '중용', '정병', '이상우', '나중'], ['자율', '주행', '자동차', '보안', '기술', '동향'], ['전자통신', '동향', '분석', '년월', '접속'], ['정보보호', '학회'], ['저자', '소개'], ['학회'], ['년월', '년월', '상명대'], ['컴퓨터공학'], ['년월', '현재', '세종', '대학', '교정'], ['보보', '호학', '재학'], ['관심', '분야', '네트워크', '보안', '시스템'], ['보안', '이중혁'], ['회원', '년월', '성균관대', '학교', '공학', '박사'], ['년월', '년월', '프랑스'], ['연구원'], ['년월', '년월', '프랑스'], ['그랑제꼴'], ['교수'], ['년월', '년월', '상명대학교', '소프트웨어', '학과'], ['교수'], ['년월', '현재', '세종대', '학교', '정보보호', '학과', '부교수'], ['관심', '분야', '프로토콜', '엔지니어링', '정보보호']]

## 2. 머신러닝 모델 학습

### 2.1 lda 모델 및 coherence 모델에 필요한 데이터 생성

```
In [8]: from gensim import corpora
texts = words
dictionary = corpora.Dictionary(texts) # 단어가 겹치지 않도록 하나씩 dictionary에 저장
corpus = [dictionary.doc2bow(text) for text in texts] # 단어를 bag-of-words 형태로 변환

print(dictionary)
print(corpus)
```

Dictionary<1168 unique tokens: ['연구원', '전자통신', '한국', '과거', '드라마']...>  
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1)], [(82, 1), (766, 1), (771, 1)], [(46, 1), (162, 1), (1101, 1)], [(46, 1), (1114, 1)], [(7, 1), (8, 1), (11, 1), (44, 1), (199, 1), (765, 2), (969, 1), (1115, 1)], [(7, 1), (8, 1), (11, 1), (46, 1), (48, 1), (765, 1)], [(7, 1), (8, 1), (11, 1), (130, 1), (809, 1)], [(126, 1), (129, 1), (250, 1), (915, 1), (916, 1)], [(307, 1), (765, 1), (766, 1), (770, 1), (1082, 1)], [(809, 1)], [(7, 1), (8, 1), (11, 1), (253, 1)], [(153, 1), (565, 1), (1116, 1)], [(204, 1)], [(46, 1), (765, 1), (1117, 1), (1118, 1)], [(540, 1), (914, 1), (923, 1), (1061, 1), (1069, 1), (1119, 1)], [(17, 1), (417, 1), (765, 1), (923, 1), (1120, 1), (1121, 1)], [(942, 1), (1060, 1), (1122, 1), (1123, 1), (1124, 1), (1125, 1), (1126, 1)], [(7, 1), (8, 1), (11, 1), (46, 1), (48, 1), (765, 1), (766, 1)], [(710, 1), (942, 2), (1127, 1)], [(809, 1), (1114, 1), (1128, 1)], [(46, 1), (53, 1), (765, 1

```

), (1060, 1)], [(170, 1), (1129, 1)], [(46, 1), (166, 1), (765, 1)], [(130, 1), (184, 1), (1130, 1)], [(7, 1),
(8, 1), (11, 1), (44, 1), (569, 1), (765, 1), (809, 1), (1115, 1)], [(63, 1)], [(7, 1), (8, 1), (11, 1), (30, 1
), (786, 1), (787, 1), (788, 1)], [(26, 1), (38, 1), (117, 1), (736, 1), (789, 1), (790, 1)], [(153, 1), (327,
1), (786, 1), (792, 1), (793, 1), (796, 1)], [(7, 1), (8, 1), (236, 1), (479, 1), (646, 1)], [(7, 1), (11, 1),
(43, 1), (76, 1), (472, 1), (713, 1)], [(839, 1)], [(43, 1), (611, 1), (774, 1)], [(7, 1), (8, 2), (11, 1), (46
, 1), (48, 1), (794, 1)], [(7, 1), (11, 1), (526, 1), (765, 2), (766, 2)], [(8, 1), (11, 1), (53, 1), (1131, 1)
], [(46, 1), (48, 1), (765, 1), (809, 1)], [(774, 1)], [(7, 1), (11, 1), (611, 1), (765, 1), (766, 1), (826, 1)
], [(46, 1), (611, 1), (765, 2), (766, 1)], [(76, 1), (153, 1)], [(7, 1), (8, 1), (11, 1), (1132, 1)], [(749, 1
), (805, 1), (820, 1), (1133, 1)], [(472, 1), (713, 1), (805, 1), (806, 1)], [(46, 1), (53, 1), (54, 1), (76, 1
), (611, 1), (765, 1), (1134, 1)], [(416, 1)], [(674, 1)], [(1110, 1)], [(1135, 1), (1136, 1), (1137, 1), (1138
, 1)], [(8, 1)], [(7, 1), (48, 1), (765, 1)], [(344, 1), (779, 1)], [(7, 1), (8, 1), (11, 1), (472, 1), (900, 1
), (1139, 1)], [(871, 1)], [(1110, 1)], [(871, 1), (1110, 1)], [(1140, 1), (1141, 1)], [(8, 1), (11, 1), (26, 1
), (180, 1)], [(371, 1), (770, 1), (864, 1), (1142, 1), (1143, 1), (1144, 1)], [(2, 1), (7, 1), (344, 1), (774,
1)], [(8, 1), (11, 1), (46, 1), (448, 1)], [(871, 1), (1110, 1)], [(8, 1), (11, 1), (434, 1), (437, 1), (891, 1
)], [(871, 1), (1110, 1)], [(1145, 1), (1146, 1)], [(57, 1), (58, 1), (126, 1), (891, 1), (1039, 1)], [(66, 1)]
], [(1147, 1)], [(68, 1), (1136, 1), (1148, 1), (1149, 1), (1150, 1), (1151, 1)], [(7, 1), (8, 1), (11, 1), (46,
1), (48, 1), (765, 1)], [(1, 1), (48, 1), (82, 1)], [(871, 1), (1110, 1)], [(344, 1), (779, 1)], [(254, 1), (11
52, 1)], [(1153, 1)], [(871, 2), (1154, 1)], [(1155, 1)], [(204, 1), (270, 1), (871, 1), (1156, 1), (1157, 1)],
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64, 1)], [(1165, 1)], [(133, 1)], [(781, 1), (871, 2), (942, 1), (1166, 1)], [(133, 1)], [(204, 1), (647, 1), (
778, 1), (779, 1), (781, 1), (782, 1), (871, 1)], [(213, 1), (252, 1), (779, 1), (780, 1), (1167, 1)]]

```

## 2.2 모델 학습

lda 모델에 corpus와 dictionary를 넣어서 잘 되는지 확인

```

In [9]: from gensim import models
from gensim import corpora

# num_topics를 2로 설정
lda = models.LdaModel(corpus=corpus, id2word=dictionary, num_topics=2, random_state = 1)

for t in lda.show_topics(): # 주제마다 출현 확률이 높은 단어 순으로 출력
    print(t)

(0, '0.040*주행' + 0.035*자율' + 0.018*차량' + 0.018*기술' + 0.011*운전' + 0.011*운전자' + 0.009*공격' + 0.00
9*자동차' + 0.008*환경' + 0.008*수행')
(1, '0.053*주행' + 0.046*자동차' + 0.037*자율' + 0.027*차량' + 0.019*기술' + 0.016*보안' + 0.013*시스템' + 0.
012*통해' + 0.011*운전자' + 0.008*경우')

```

coherence모델을 사용하여 coherence값이 높을때의 topics로 num\_topics를 지정

```

In [10]: from gensim import models
from gensim.models.coherencemodel import CoherenceModel
coherence_values = []
model_list = []
for num_topics in range(2,30):# num_topics를 2부터 29까지 계속 넣어보면서 coherence값이 가장 높은 num_topics를 찾음
    model = models.LdaModel(corpus=corpus, id2word=dictionary, num_topics=num_topics) #위에서 생성했음
    model_list.append(model)
    coherencemodel = CoherenceModel(model=model, texts=texts, dictionary=dictionary, coherence='c_v')
    coherence_values.append(coherencemodel.get_coherence())

print(model_list)
print('\n\n')
print(coherence_values)

max_num_topics = 0
num_topic = 0
# c_v 점수가 높은 num_topic을 찾음 -> 연관성 문제
for i in range(len(coherence_values)):
    if coherence_values[i] > max_num_topics:
        max_num_topics = coherence_values[i]
        num_topic = i
print('num_topics = {}'.format(num_topic))

```

```
[0.35031571997471966, 0.34694332203764366, 0.4075524605020014, 0.42343210758223415, 0.42210193762034404, 0.4304
1139338096945, 0.41310286869277346, 0.42547507715204397, 0.4387964462877645, 0.42198425536877937, 0.44796403894
47637, 0.4636450042772667, 0.4721737049435747, 0.466157943042828, 0.45972751851308963, 0.48015370922844103, 0.
4799458016233175, 0.47934070717503835, 0.4882779979392062, 0.49347250485886024, 0.48635338145754886, 0.49863315
23053052, 0.4811683926534364, 0.5025950172925098, 0.49402377392100916, 0.4905375167719596, 0.4950328109845009,
0.5037413312272819]
num topics = 27
```

```
In [11]: from gensim.models.callbacks import CoherenceMetric
from gensim.models.callbacks import PerplexityMetric

perplexity_logger = PerplexityMetric(corpus=corpus, logger='shell')
coherence_logger = CoherenceMetric(corpus=corpus, coherence="u_mass", logger='shell')

lda_model = models.ldamodel.LdaModel(corpus, id2word=dictionary, num_topics=num_topic, passes=30)

topics = lda_model.print_topics(num_words=5)
for topic in topics:
    print(topic)

(15, '0.075*"차량" + 0.066*"센서" + 0.045*"인식" + 0.033*"존재" + 0.027*"주행"')
(9, '0.225*"공격" + 0.041*"교수" + 0.036*"경우" + 0.023*"수행" + 0.021*"세바스찬"')
(10, '0.130*"보안" + 0.097*"주행" + 0.093*"자율" + 0.093*"기술" + 0.084*"자동차"')
(7, '0.227*"기술" + 0.057*"판단" + 0.040*"인지" + 0.039*"주행" + 0.035*"차량"')
(18, '0.042*"논문" + 0.036*"제정" + 0.035*"사람" + 0.030*"결론" + 0.024*"법령"')
(4, '0.103*"통해" + 0.060*"위치" + 0.060*"정보" + 0.053*"도로" + 0.036*"추정"')
(11, '0.101*"수행" + 0.053*"차량" + 0.030*"역할" + 0.030*"무인" + 0.015*"확인"')
(20, '0.157*"시스템" + 0.057*"주행" + 0.036*"운전자" + 0.035*"기반" + 0.025*"지도"')
(22, '0.050*"학회" + 0.043*"진단" + 0.036*"정보보호" + 0.036*"통합" + 0.029*"이용"')
(6, '0.029*"경우" + 0.023*"시간" + 0.023*"이상" + 0.023*"반응" + 0.022*"인터페이스"')
(13, '0.149*"운전" + 0.063*"제어" + 0.048*"운전자" + 0.046*"파일럿" + 0.022*"사고"')
(21, '0.077*"프로젝트" + 0.023*"활용" + 0.023*"현대" + 0.023*"기아" + 0.019*"무인"')
(1, '0.089*"자동" + 0.052*"시스템" + 0.038*"속도" + 0.033*"유도" + 0.022*"문제"')
(3, '0.083*"운전자" + 0.050*"협약" + 0.040*"시스템" + 0.038*"비엔나" + 0.027*"개입"')
(14, '0.247*"주행" + 0.224*"자율" + 0.191*"자동차" + 0.021*"그림" + 0.016*"경우"')
(0, '0.057*"사용" + 0.039*"상용" + 0.034*"펌웨어" + 0.030*"통과" + 0.023*"위해"')
(2, '0.117*"년월" + 0.070*"발생" + 0.046*"접속" + 0.042*"차량" + 0.026*"사고"')
(26, '0.069*"도한" + 0.062*"분석" + 0.054*"제호" + 0.054*"동향" + 0.046*"전자통신"')
(23, '0.050*"차량" + 0.036*"위해" + 0.027*"소프트웨어" + 0.022*"차선" + 0.022*"정차"')
(25, '0.132*"차량" + 0.041*"유전자" + 0.031*"인식" + 0.023*"도로" + 0.023*"스스로"')
```

```
In [12]: coherence_model_lda = models.CoherenceModel(model=lda_model, texts=texts, dictionary=dictionary,
coherence_lda = coherence_model_lda.get_coherence()
print('\nCoherence Score (c_v): ', coherence_lda)

coherence_model_lda =models.coherencemodel. CoherenceModel(model=lda_model, texts=texts, dictionary=dictionary,
coherence_lda = coherence_model_lda.get_coherence()
print('\nCoherence Score (u_mass): ', coherence_lda)

Coherence Score (c_v):  0.5404757082969608

Coherence Score (u mass):  -16.678390883527218
```

### 3. 시각화

### 3.1 WordCloud로 시각화



토픽들마다 키워드들을 클라우드형태로 시각화

In [13]:

```
from wordcloud import WordCloud
import matplotlib.pyplot as plt
import math

#나눔스퀘어(bold) 글꼴 사용
wc = WordCloud(background_color='white', font_path='C:\\Users\\kimdaehan\\Downloads\\nanum-all (1)\\나눔 글꼴\\나눔스퀘어(bold).ttf')

plt.figure(figsize=(30,30))
num = lda_model.num_topics

row = math.ceil(num / 4) #한 행마다 4개씩 wordCloud를 표현

for t in range(num):
    plt.subplot(row,4,t+1)
    x = dict(lda_model.show_topic(t,300))
    im = wc.generate_from_frequencies(x)
    plt.imshow(im)
    plt.axis("off")
    plt.title("Topic #" + str(t))

plt.show() # 확인
```



### 3.2 pyLDavis로 시각화

corpus 데이터, dictionary 데이터, lda 모델 데이터를 저장하고 pyLDavis로 시각화 한것을 html형태로 저장

In [15]:

```
import pickle
import pyLDavis.gensim_models
```

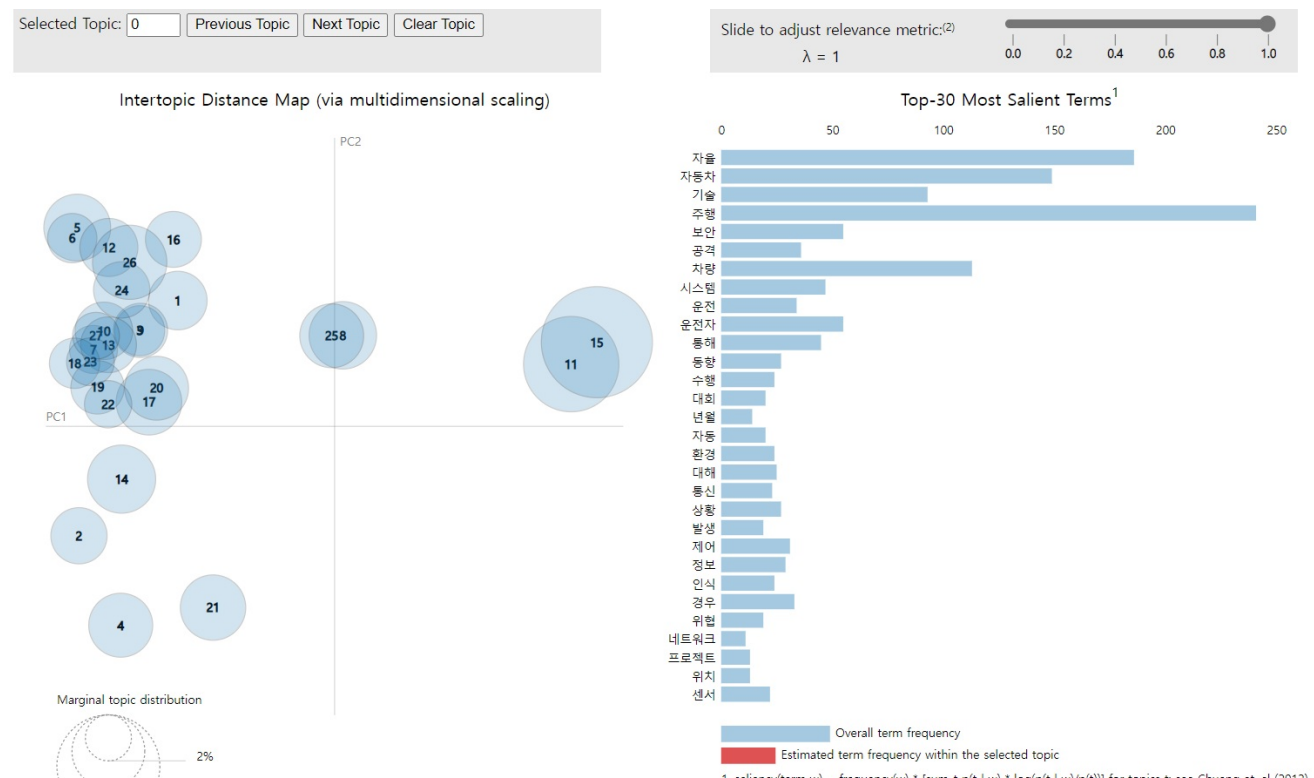


```
pickle.dump(corpus, open('C:\\Users\\kimdaehan\\Documents\\model\\lda_corpus.pkl', 'wb'))
dictionary.save('C:\\Users\\kimdaehan\\Documents\\model\\lda_dictionary.gensim')
lda_model.save('C:\\Users\\kimdaehan\\Documents\\model\\lda_model.gensim')
```

```
# pyLDAvis html 저장
```

```
lda_visualization = pyLDAvis.gensim_models.prepare(lda_model, corpus, dictionary, sort_topics=False)
pyLDAvis.save_html(lda_visualization, 'C:\\Users\\kimdaehan\\Documents\\model\\show_lda.html')
```

C:\\Users\\kimdaehan\\anaconda3\\lib\\site-packages\\pyLDAvis\\\_prepare.py:246: FutureWarning: In a future version of pandas all arguments of DataFrame.drop except for the argument 'labels' will be keyword-only.  
default\_term\_info = default\_term\_info.sort\_values()



## 프로젝트 발전성

현재 프로젝트는 한국어에 한에서만 진행했다. 영어 문서의 경우는 고려하지 않았지만 나중에 영어, 한국어 구분해서 학습을 시켜볼예정이다.

그리고 웹에서 작동되게 해서 웹서비스로 운영되면 좋을것으로 생각되어 웹서비스 프로젝트도 진행하려고 생각중이다.

## 프로젝트 후기

이번에 처음으로 주피터를 사용해서 머신러닝 프로젝트를 진행해보았다. 엘리스 강의에서 배웠던 내용, 구글링을 통한 모델 내용 등등 여러가지 방법을 적용하면서 점점 완성되어가는 프로젝트를 보니 상당한 재미를 느꼈고 나의 부족한 점 또한 많이 알게되었다.다음에도 이런 기회가 있다면 더 고난이도의 프로젝트를 진행해보고 싶다.

In [ ]:

Loading [MathJax]/extensions/Safe.js