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Impact of Climate Change Mitigation Technologies on Sustainable Development Transition

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Introduction

- Climate change and its destructive effects.
- The Paris Agreement, adopted in 2015, aims to strengthen the global response to the threat of climate change.
 - keeping a global temperature rise below two degrees celsius (above pre-industrial levels).
 - strengthen the ability of countries to deal with the impacts of climate change through appropriate financial flows, a new technology framework and an enhanced capacity-building framework.
- Towards achieving the United Nation's Sustainable Development Goals (SDGs) to end poverty, build stronger economies and safer, healthier, and more livable societies everywhere.

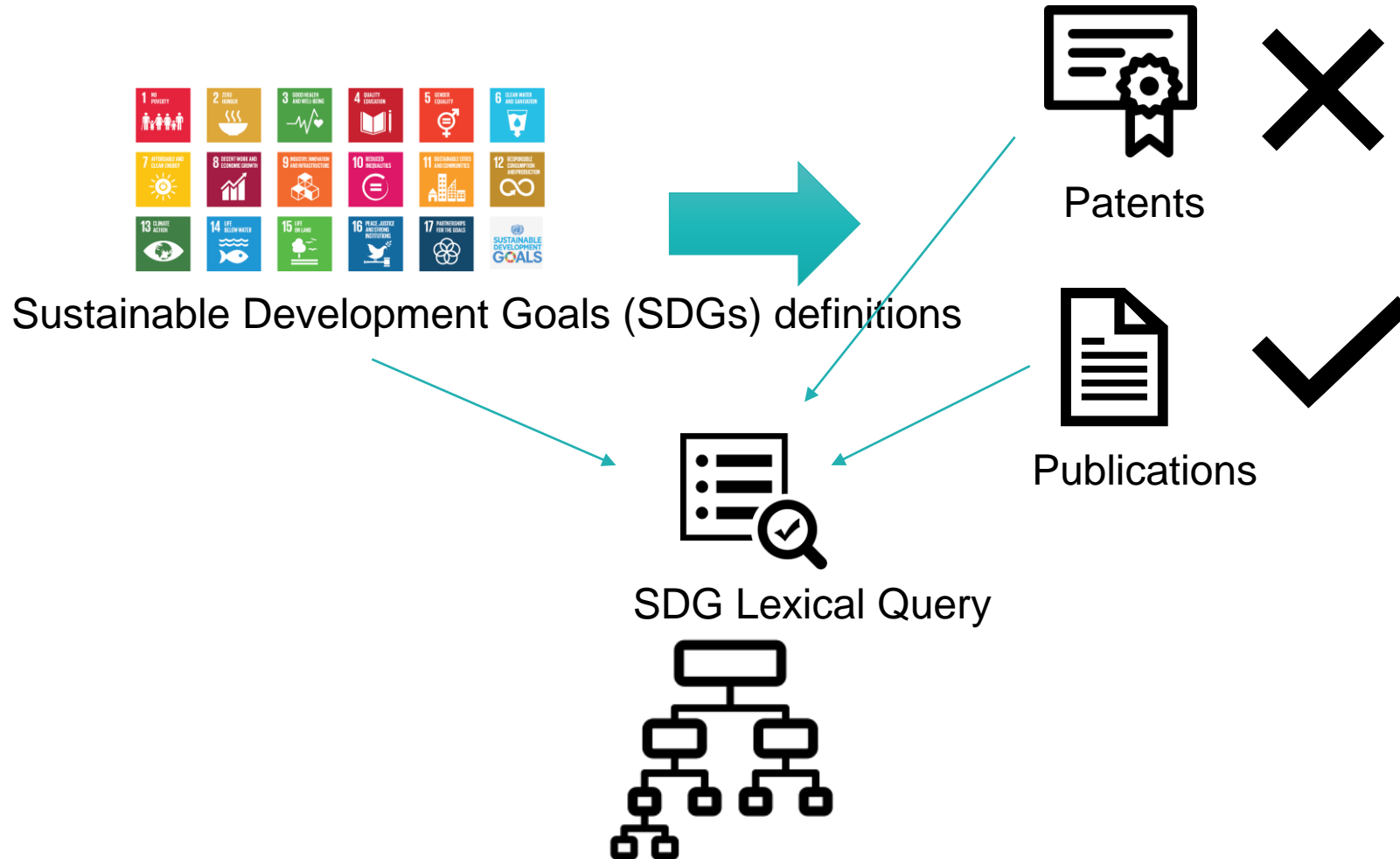
Background

- Science, technology and innovation are among the forefront tools to combat climate change and reduce its effects.
- Climate change mitigation technologies (CCMTs) or green technology, also called "environmentally sound technologies" or "climate friendly technologies", cover the full spectrum of innovation that protects the environment.
- Since the United Nations Framework Convention on Climate Change (UNFCCC) Bali meeting 2007, the role of the intellectual property and patenting systems has been the subject of increased attention in climate change discussions on technology adoption and transfer
- Over the past decade, many CCMTs have experienced increased levels of innovation and cost reductions (i.e. solar photovoltaic (P.V.))
- Developing CCMTs is a crucial challenge to temper the costs associated with climate change and air pollution consequences.

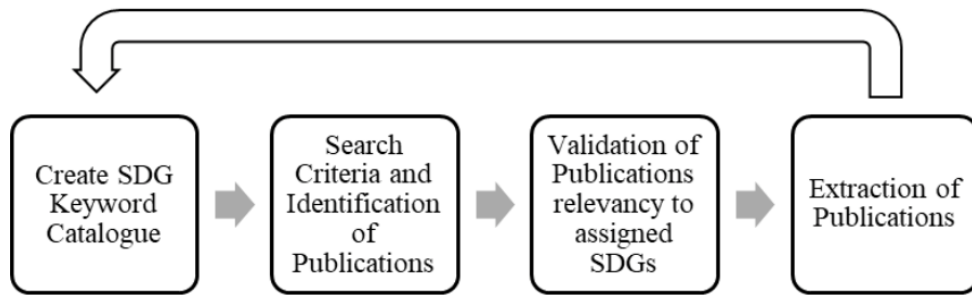
Background II

- Our search indicated 482 thousand CCMT related patents in the E.U. since 2000, focusing on topical technology domains such as internal combustion engine, solar cell, fuel cell, and wind power.
- Understanding the evolution of CCMTs and their diverse contribution to other global challenges is essential in projecting future impacts and true costs of climate change and pollution-related activities.
- To inform decision-making, we need to understand better and make visible CCMTs and the science and technology interconnections these technologies have on SDGs.
- Accurate and accessible indicators on the development of science and technology that contributes to the SDGs will allow the development of public policies and strategies that leverage novel capabilities, ultimately making CCMT more accessible than they are today

Methodology I

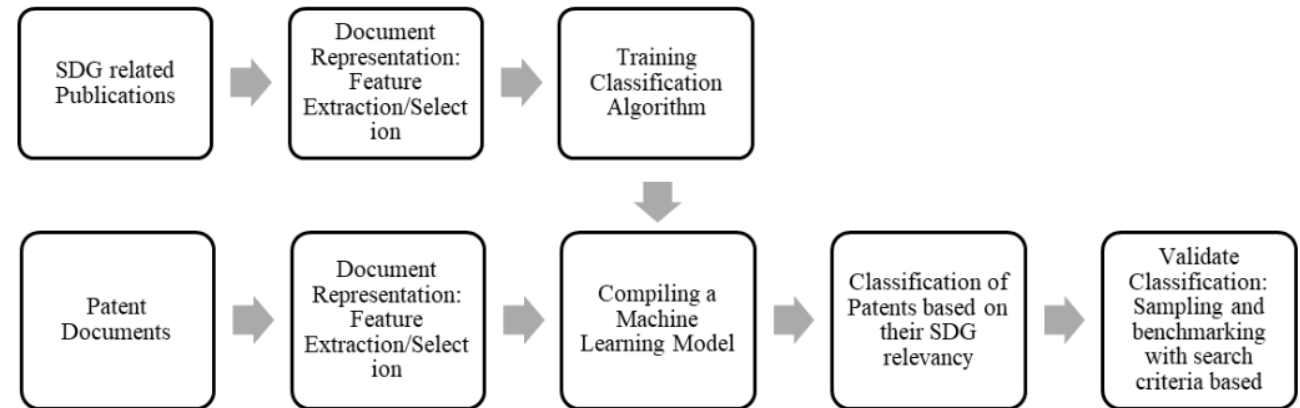


Methodology II



Workflow process of identifying and retrieving SDG related publications

Workflow and study design for the Sustainable Development Goals (SDG) detection and mapping of intellectual property documents



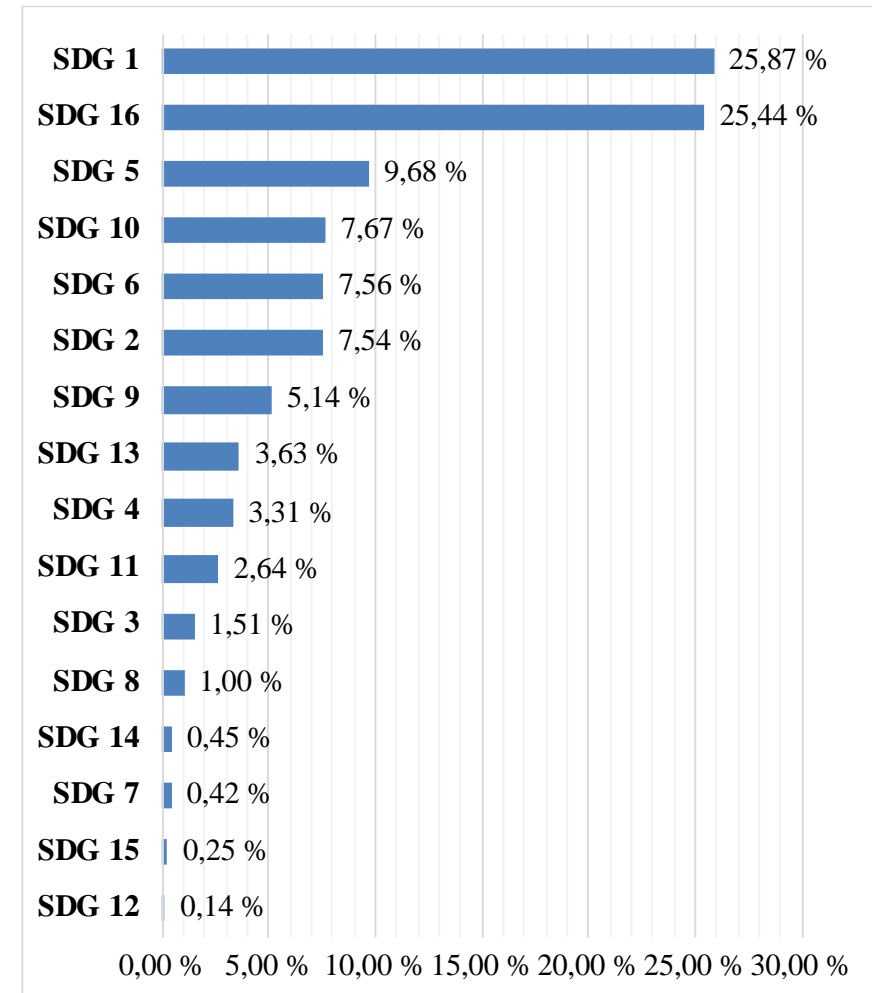
Analysis

- Train three classifiers using Python’s Scikit-Learn library and Gensim library.
- The highest overall accuracy (f-score) is achieved by “Word2vec and logistic regression” model.
- Acceptable accuracy (above 60%) for most of the SDG classes such as: SDG 1, 2, 3, 4, 5, 6, 7, 9, 10, 13 and 16.

	NAIVE BAYES CLASSIFIER FOR MULTINOMIAL MODELS			LINEAR SUPPORT VECTOR MACHINE			WORD2VEC AND LOGISTIC REGRESSION		
	precision	recall	f1-score	precision	recall	f1-score	precision	recall	f1-score
SDG1	0.53	0.75	0.62*	0.67	0.72	0.69*	0.65	0.68	0.66*
SDG2	0.57	0.60	0.58	0.57	0.67	0.62*	0.61	0.62	0.62*
SDG3	0.82	0.88	0.85*	0.69	0.93	0.79*	0.86	0.87	0.86*
SDG4	0.75	0.74	0.74*	0.71	0.87	0.78*	0.78	0.75	0.76*
SDG5	0.55	0.72	0.63*	0.59	0.79	0.68*	0.65	0.61	0.63*
SDG6	0.57	0.63	0.60*	0.58	0.76	0.66*	0.62	0.66	0.64*
SDG7	0.83	0.78	0.80*	0.69	0.86	0.76*	0.82	0.84	0.83*
SDG8	0.50	0.46	0.48	0.59	0.40	0.48	0.52	0.46	0.49
SDG9	0.49	0.66	0.56	0.61	0.70	0.65*	0.59	0.66	0.62*
SDG10	0.69	0.45	0.54	0.76	0.56	0.64*	0.63	0.56	0.60*
SDG11	0.51	0.44	0.47	0.55	0.54	0.55	0.53	0.54	0.53
SDG12	0.56	0.40	0.47	0.65	0.36	0.46	0.54	0.49	0.51
SDG13	0.50	0.64	0.56	0.55	0.60	0.58	0.56	0.59	0.58
SDG14	0.16	0.16	0.16	0.13	0.10	0.11	0.31	0.37	0.34
SDG15	0.10	0.07	0.09	0.09	0.06	0.07	0.25	0.19	0.22
SDG16	0.73	0.49	0.58	0.74	0.51	0.61*	0.60	0.69	0.65*

Results II

- Relevancy of each CCMT patent document to any of the SDGs with the distribution of probability percentage to each SDG
- Accumulative highest to lowest relevant SDGs addressed in the patent title and abstract texts.
- Relatedness of CCMT patents to SDG 1 and 16 with 25% relation. The relatedness extends to SDG 5, 10, 6 and 2 with a total of 32%. There are captured relationships to other SDGs but with minimal textual pattern relatedness.



Conclusion

- Investigates the extended relationship between Climate Change Mitigation Technologies (CCMTs) and other wicked global problems categorized by United Nations' Sustainable Development Goals (SDGs)
- Infer the relationships and interconnectedness with the textual content of patents and publications with Natural Language Processing (NLP) techniques
- Systematically comprehending sustainability-oriented publications, creating a catalogue for sustainable development goals. Based on the publications with the highest relatedness to SDGs, compiling a Machine Learning (ML) model to detect the relatedness of another type of scientific and technological innovation.
- The ML model learned and applied to identify the relatedness of CCMT to SDGs.
- Our research design revealed the linkage between CCMT patents and SDGs so to learn the extended impact of such crucial technologies to our wider global challenges.

Thanks for your attention!

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