|  |  |  |
| --- | --- | --- |
| Description |  | Clusters |
| KM + WordNet removal + similarity matrix formed using pretrained on wiki news FastText |  | K=22 [['biorhythm app',  'radio system',  'wireless charger',  'mobile phone',  'auto sprinkler',  'socket adapter',  'video camera',  'audio listening',  'smartwatch application'],  ['stovetops', 'electricity', 'heater', 'thermostat', 'temprature'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['outside temperature',  'desired temperature',  'optimal condition',  'ideal temperature',  'optimal temperature'],  ['battery limit',  'movie suggestion',  'push notification',  'personal preference',  'class reminder',  'added measure',  'scheduled timing',  'package delivery',  'weather adjustment',  'voice command',  'packaging information',  'team goal',  'health goal',  'respiratory issue',  'overall health',  'background music',  'text message',  'weather alert'],  ['text', 'shock', 'sound', 'remote', 'music', 'lighting', 'television'],  ['night sleep',  'baby room',  'kitchen item',  'single room',  'breakfast food',  'space heater',  'room lighting',  'food bowl'],  ['energy use',  'energy bill',  'energy cost',  'food preparation',  'energy consumption',  'heat source',  'dangerous gas'],  ['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart coffee machine',  'smart thermostat',  'smart breakfast appliance',  'smart feature'],  ['window sensor', 'window fan', 'ceiling fan', 'garage door'],  ['appliance', 'app', 'device', 'smartphone', 'sensor'],  ['house simultaneously party',  'family member',  'teenage child',  'child nears',  'registered occupant',  'party guest',  'young child movement'],  ['anything', 'anyone', 'something'],  ['new movie',  'main gate',  'air quality',  'new product',  'regular furnace',  'relevant information',  'remote location',  'central system'],  ['outdoor motion detector',  'ductless heat pump',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light',  'automatic fragrance sprinkler'],  ['recommendation', 'notification'],  ['home turn',  'full home sport',  'smart home',  'home safety',  'smart home',  'home air'],  ['good night',  'favorite show',  'appropriate time',  'different time',  'big saving',  'other thing',  'certain light',  'long day',  'dangerous place',  'limit benefit',  'day benefit',  'good way',  'such place',  'lunch time'],  ['optimal'],  ['occurs', 'door', 'shower', 'intruder', 'window', 'lock', 'greets'],  ['tv', 'etc', 'nfc'],  ['snow high wind',  'potential health concern',  'air purity controller',  'plant soil',  'order delivery food',  'remote control opener',  'minimum required amount',  'pet water container',  'nice walk today',  'easy status update',  'pleasant mood everytime',  'potential weather issue',  'integrated roomba vacuum']] K=30 [['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light'],  ['snow high wind', 'minimum required amount'],  ['home turn', 'full home sport', 'air quality', 'home safety', 'home air'],  ['battery limit',  'outside temperature',  'space heater',  'desired temperature',  'regular furnace',  'ideal temperature',  'heat source',  'optimal temperature'],  ['etc'],  ['teenage child', 'child nears', 'young child movement'],  ['tv', 'television'],  ['movie suggestion',  'push notification',  'class reminder',  'added measure',  'team goal',  'text message'],  ['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart thermostat',  'smart home',  'smart home',  'smart feature'],  ['smart coffee machine', 'smart breakfast appliance'],  ['biorhythm app',  'radio system',  'wireless charger',  'mobile phone',  'food preparation',  'breakfast food',  'package delivery',  'voice command',  'packaging information',  'video camera',  'audio listening',  'food bowl',  'smartwatch application',  'background music',  'central system'],  ['nfc'],  ['occurs', 'anything', 'anyone', 'something'],  ['night sleep', 'long day'],  ['nice walk today', 'easy status update', 'pleasant mood everytime'],  ['window sensor', 'window fan'],  ['scheduled timing',  'weather adjustment',  'limit benefit',  'day benefit',  'optimal condition',  'lunch time',  'weather alert'],  ['baby room',  'kitchen item',  'single room',  'main gate',  'room lighting',  'garage door'],  ['recommendation',  'text',  'sound',  'notification',  'optimal',  'music',  'lighting'],  ['air purity controller',  'ductless heat pump',  'remote control opener',  'pet water container',  'automatic fragrance sprinkler',  'integrated roomba vacuum'],  ['stovetops', 'electricity', 'heater', 'thermostat', 'temprature'],  ['good night',  'favorite show',  'appropriate time',  'different time',  'new movie',  'big saving',  'other thing',  'personal preference',  'certain light',  'new product',  'dangerous place',  'good way',  'such place',  'relevant information',  'remote location'],  ['plant soil',  'energy use',  'energy bill',  'energy cost',  'energy consumption',  'dangerous gas'],  ['auto sprinkler', 'socket adapter', 'registered occupant', 'ceiling fan'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['shock', 'shower', 'intruder', 'greets'],  ['appliance', 'app', 'device', 'smartphone', 'sensor'],  ['door', 'remote', 'window', 'lock'],  ['potential health concern',  'order delivery food',  'health goal',  'potential weather issue',  'respiratory issue',  'overall health'],  ['house simultaneously party', 'family member', 'party guest']] K=53 [['ceiling fan'],  ['smart electronics', 'smart device'],  ['smart carbon monoxide detector'],  ['hallway motion detector'],  ['house simultaneously party',  'family member',  'teenage child',  'child nears',  'registered occupant',  'party guest',  'young child movement'],  ['good night', 'night sleep', 'long day', 'day benefit', 'lunch time'],  ['energy use',  'energy bill',  'air quality',  'energy cost',  'energy consumption'],  ['door', 'window', 'lock'],  ['tv', 'app', 'smartphone'],  ['electricity', 'lighting'],  ['scheduled timing', 'package delivery'],  ['minimum required amount'],  ['auto sprinkler', 'automatic fragrance sprinkler'],  ['temprature'],  ['biorhythm app', 'smartwatch application'],  ['smart coffee machine', 'smart breakfast appliance'],  ['favorite show',  'new movie',  'other thing',  'new product',  'relevant information'],  ['order delivery food'],  ['etc', 'nfc'],  ['dangerous place', 'remote location', 'dangerous gas'],  ['potential health concern',  'weather adjustment',  'potential weather issue',  'respiratory issue',  'weather alert'],  ['snow high wind',  'air purity controller',  'ductless heat pump',  'pet water container',  'integrated roomba vacuum'],  ['radio system', 'wireless charger', 'mobile phone'],  ['recommendation', 'text', 'notification'],  ['carbon monoxide', 'carbon monoxide detector'],  ['personal preference', 'team goal', 'health goal', 'overall health'],  ['movie suggestion', 'push notification', 'class reminder', 'text message'],  ['home turn', 'home safety', 'home air'],  ['voice command', 'video camera', 'audio listening', 'background music'],  ['occurs', 'anything', 'anyone', 'shower', 'intruder', 'greets'],  ['remote'],  ['main gate', 'regular furnace', 'central system'],  ['certain light', 'good way', 'such place'],  ['added measure'],  ['kitchen item', 'space heater', 'packaging information'],  ['food preparation', 'breakfast food', 'food bowl'],  ['optimal condition'],  ['outside temperature',  'desired temperature',  'ideal temperature',  'heat source',  'optimal temperature'],  ['smart thermostat'],  ['big saving'],  ['battery limit', 'limit benefit'],  ['appropriate time', 'different time'],  ['nice walk today', 'easy status update', 'pleasant mood everytime'],  ['appliance', 'device', 'sensor'],  ['plant soil'],  ['socket adapter'],  ['shock', 'sound', 'something', 'optimal', 'music', 'television'],  ['window sensor', 'window fan', 'garage door'],  ['full home sport', 'remote control opener', 'outdoor safety light'],  ['outdoor motion detector', 'outdoor motion sensor'],  ['stovetops', 'heater', 'thermostat'],  ['baby room', 'single room', 'room lighting'],  ['smart shower', 'smart lock', 'smart home', 'smart home', 'smart feature']] |
| EM + WordNet removal + similarity matrix formed using pretrained on wikinews FastText |  | K=21 [['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart home',  'smart home',  'smart feature'],  ['house simultaneously party',  'snow high wind',  'potential health concern',  'air purity controller',  'plant soil',  'ductless heat pump',  'order delivery food',  'remote control opener',  'minimum required amount',  'pet water container',  'automatic fragrance sprinkler',  'pleasant mood everytime',  'potential weather issue',  'integrated roomba vacuum',  'young child movement'],  ['anything', 'anyone', 'something'],  ['favorite show',  'movie suggestion',  'new movie',  'big saving',  'push notification',  'other thing',  'main gate',  'personal preference',  'certain light',  'added measure',  'new product',  'dangerous place',  'good way',  'such place',  'remote location'],  ['door', 'window', 'lock'],  ['window sensor', 'window fan', 'ceiling fan', 'garage door'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['tv',  'stovetops',  'electricity',  'heater',  'etc',  'thermostat',  'temprature'],  ['nfc'],  ['appliance', 'app', 'device', 'smartphone', 'sensor'],  ['biorhythm app',  'battery limit',  'radio system',  'wireless charger',  'class reminder',  'mobile phone',  'auto sprinkler',  'socket adapter',  'voice command',  'video camera',  'audio listening',  'smartwatch application',  'text message'],  ['good night',  'appropriate time',  'different time',  'scheduled timing',  'long day',  'limit benefit',  'day benefit',  'relevant information',  'lunch time'],  ['night sleep',  'food preparation',  'breakfast food',  'package delivery',  'food bowl',  'background music'],  ['text', 'sound', 'music', 'lighting', 'television'],  ['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light'],  ['energy use',  'energy bill',  'air quality',  'energy cost',  'packaging information',  'health goal',  'respiratory issue',  'overall health',  'energy consumption',  'dangerous gas'],  ['recommendation',  'occurs',  'shock',  'shower',  'remote',  'notification',  'intruder',  'optimal',  'greets'],  ['home turn',  'full home sport',  'team goal',  'home safety',  'central system',  'home air'],  ['smart coffee machine',  'smart thermostat',  'nice walk today',  'smart breakfast appliance',  'easy status update'],  ['outside temperature',  'weather adjustment',  'desired temperature',  'optimal condition',  'ideal temperature',  'heat source',  'optimal temperature',  'weather alert'],  ['baby room',  'kitchen item',  'single room',  'family member',  'space heater',  'teenage child',  'room lighting',  'child nears',  'regular furnace',  'registered occupant',  'party guest']] K=42 [['good night',  'night sleep',  'scheduled timing',  'long day',  'limit benefit',  'day benefit'],  ['recommendation', 'text', 'notification'],  ['food preparation', 'breakfast food', 'food bowl'],  ['order delivery food', 'package delivery'],  ['biorhythm app',  'radio system',  'window sensor',  'voice command',  'video camera',  'audio listening'],  ['smart home', 'smart home'],  ['heater', 'thermostat'],  ['tv'],  ['plant soil', 'pet water container'],  ['nfc'],  ['air quality', 'space heater', 'heat source', 'dangerous gas'],  ['health goal', 'overall health'],  ['snow high wind',  'air purity controller',  'ductless heat pump',  'remote control opener',  'minimum required amount',  'automatic fragrance sprinkler'],  ['anyone', 'greets'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['baby room',  'kitchen item',  'single room',  'main gate',  'room lighting',  'regular furnace',  'window fan',  'garage door'],  ['appliance', 'remote', 'device', 'sensor'],  ['door', 'window', 'lock'],  ['house simultaneously party', 'full home sport', 'integrated roomba vacuum'],  ['smart coffee machine', 'smart thermostat', 'smart breakfast appliance'],  ['personal preference',  'relevant information',  'background music',  'remote location',  'central system'],  ['teenage child', 'child nears', 'young child movement'],  ['occurs', 'shock', 'shower', 'intruder'],  ['energy use', 'energy bill', 'energy cost', 'energy consumption'],  ['sound', 'music', 'television'],  ['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart feature'],  ['favorite show', 'movie suggestion', 'new movie', 'new product'],  ['family member',  'team goal',  'registered occupant',  'party guest',  'ceiling fan'],  ['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light'],  ['home turn', 'home safety', 'home air'],  ['nice walk today', 'easy status update', 'pleasant mood everytime'],  ['appropriate time',  'different time',  'big saving',  'other thing',  'certain light',  'dangerous place',  'good way',  'such place',  'lunch time'],  ['anything', 'something'],  ['electricity', 'lighting'],  ['potential health concern',  'weather adjustment',  'potential weather issue',  'respiratory issue',  'weather alert'],  ['battery limit',  'wireless charger',  'mobile phone',  'auto sprinkler',  'socket adapter',  'smartwatch application'],  ['etc'],  ['push notification',  'class reminder',  'added measure',  'packaging information',  'text message'],  ['outside temperature',  'desired temperature',  'optimal condition',  'ideal temperature',  'optimal temperature'],  ['stovetops', 'temprature'],  ['app', 'smartphone'],  ['optimal']] K=62 [['app', 'smartphone'],  ['personal preference', 'remote location'],  ['full home sport', 'outdoor safety light'],  ['air purity controller',  'plant soil',  'ductless heat pump',  'pet water container',  'integrated roomba vacuum'],  ['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart feature'],  ['etc'],  ['teenage child', 'child nears', 'young child movement'],  ['occurs', 'intruder'],  ['main gate'],  ['radio system', 'central system'],  ['door', 'window', 'lock'],  ['sound', 'music'],  ['good night', 'good way'],  ['nfc'],  ['electricity', 'lighting'],  ['outside temperature',  'desired temperature',  'optimal condition',  'ideal temperature',  'optimal temperature'],  ['energy use', 'energy bill', 'energy cost', 'energy consumption'],  ['appropriate time',  'different time',  'big saving',  'other thing',  'certain light',  'dangerous place',  'such place',  'lunch time'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor'],  ['added measure', 'scheduled timing'],  ['food preparation', 'breakfast food', 'food bowl'],  ['nice walk today', 'easy status update', 'pleasant mood everytime'],  ['recommendation', 'notification'],  ['stovetops', 'heater', 'thermostat'],  ['socket adapter'],  ['window sensor', 'window fan', 'ceiling fan', 'garage door'],  ['push notification', 'class reminder', 'text message'],  ['home turn', 'air quality', 'home safety', 'home air'],  ['appliance', 'device', 'sensor'],  ['space heater', 'regular furnace', 'heat source'],  ['weather adjustment', 'weather alert'],  ['smart coffee machine', 'smart thermostat', 'smart breakfast appliance'],  ['tv'],  ['biorhythm app', 'smartwatch application'],  ['anything', 'anyone', 'something'],  ['favorite show', 'movie suggestion', 'new movie', 'new product'],  ['team goal', 'health goal', 'overall health'],  ['smart home', 'smart home'],  ['auto sprinkler', 'automatic fragrance sprinkler'],  ['potential health concern', 'potential weather issue'],  ['house simultaneously party',  'family member',  'registered occupant',  'party guest'],  ['voice command', 'background music'],  ['kitchen item'],  ['night sleep', 'long day', 'day benefit'],  ['battery limit', 'limit benefit'],  ['baby room', 'single room', 'room lighting'],  ['order delivery food'],  ['wireless charger', 'mobile phone'],  ['shock', 'shower'],  ['dangerous gas'],  ['remote'],  ['text'],  ['temprature'],  ['snow high wind', 'minimum required amount'],  ['video camera', 'audio listening'],  ['respiratory issue'],  ['greets'],  ['television'],  ['remote control opener'],  ['package delivery', 'packaging information', 'relevant information'],  ['optimal']] |
| KM + WordNet removal + similarity matrix formed using FastText trained on homeautomation Wikipedia corpora |  | K=18 [['biorhythm app',  'radio system',  'window sensor',  'mobile phone',  'video camera',  'device',  'window fan',  'smartwatch application',  'central system'],  ['house simultaneously party',  'battery limit',  'snow high wind',  'big saving',  'wireless charger',  'main gate',  'personal preference',  'minimum required amount',  'long day',  'socket adapter',  'package delivery',  'team goal',  'easy status update',  'limit benefit',  'day benefit',  'good way',  'party guest'],  ['smart carbon monoxide detector',  'air purity controller',  'carbon monoxide',  'pet water container',  'automatic fragrance sprinkler',  'pleasant mood everytime',  'integrated roomba vacuum',  'carbon monoxide detector'],  ['appliance', 'electricity', 'heater', 'thermostat', 'lighting'],  ['outside temperature',  'desired temperature',  'ideal temperature',  'temprature',  'optimal temperature'],  ['potential health concern',  'health goal',  'potential weather issue',  'respiratory issue',  'overall health'],  ['energy use', 'energy bill', 'energy cost', 'energy consumption'],  ['remote control opener', 'remote', 'remote location', 'garage door'],  ['recommendation', 'occurs', 'optimal', 'nfc'],  ['favorite show',  'appropriate time',  'different time',  'baby room',  'home turn',  'full home sport',  'certain light',  'new product',  'room lighting',  'home safety',  'lunch time',  'weather alert',  'home air'],  ['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light'],  ['order delivery food', 'food preparation', 'breakfast food', 'food bowl'],  ['good night',  'night sleep',  'plant soil',  'ductless heat pump',  'single room',  'air quality',  'space heater',  'dangerous place',  'optimal condition',  'regular furnace',  'registered occupant',  'ceiling fan',  'such place',  'heat source',  'dangerous gas'],  ['text',  'sound',  'tv',  'notification',  'app',  'smartphone',  'music',  'window',  'television'],  ['anything',  'door',  'anyone',  'shock',  'shower',  'stovetops',  'etc',  'something',  'intruder',  'sensor',  'lock',  'greets'],  ['family member',  'teenage child',  'nice walk today',  'child nears',  'young child movement'],  ['movie suggestion',  'new movie',  'push notification',  'other thing',  'kitchen item',  'class reminder',  'added measure',  'auto sprinkler',  'scheduled timing',  'weather adjustment',  'voice command',  'packaging information',  'audio listening',  'relevant information',  'background music',  'text message'],  ['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart coffee machine',  'smart thermostat',  'smart breakfast appliance',  'smart home',  'smart home',  'smart feature']] K= 45 [['outside temperature', 'desired temperature', 'ideal temperature'],  ['potential health concern', 'health goal', 'overall health'],  ['outdoor motion sensor'],  ['plant soil', 'packaging information', 'relevant information'],  ['door', 'remote', 'lock'],  ['smart device', 'smart thermostat', 'smart home', 'smart home'],  ['appropriate time', 'different time', 'long day', 'lunch time'],  ['order delivery food', 'food preparation', 'breakfast food', 'food bowl'],  ['optimal condition', 'optimal temperature'],  ['outdoor safety light'],  ['smart carbon monoxide detector'],  ['biorhythm app', 'mobile phone', 'video camera', 'smartwatch application'],  ['smart shower',  'smart electronics',  'smart lock',  'smart coffee machine',  'smart breakfast appliance',  'smart feature'],  ['snow high wind',  'ductless heat pump',  'pet water container',  'regular furnace',  'heat source'],  ['favorite show'],  ['good night',  'auto sprinkler',  'automatic fragrance sprinkler',  'pleasant mood everytime'],  ['air purity controller', 'air quality'],  ['radio system', 'central system'],  ['kitchen item',  'class reminder',  'added measure',  'scheduled timing',  'background music'],  ['team goal', 'good way'],  ['energy use',  'energy bill',  'energy cost',  'electricity',  'energy consumption'],  ['package delivery'],  ['home turn', 'full home sport', 'home safety', 'home air'],  ['appliance', 'lighting'],  ['window sensor', 'sensor'],  ['space heater', 'heater', 'window fan', 'ceiling fan'],  ['dangerous place', 'such place', 'dangerous gas'],  ['house simultaneously party', 'party guest'],  ['night sleep', 'baby room', 'single room', 'certain light', 'room lighting'],  ['remote control opener', 'remote location', 'garage door'],  ['teenage child', 'nice walk today', 'child nears', 'young child movement'],  ['carbon monoxide', 'carbon monoxide detector'],  ['limit benefit', 'day benefit'],  ['minimum required amount', 'easy status update', 'integrated roomba vacuum'],  ['shower', 'thermostat', 'temprature'],  ['other thing', 'weather adjustment', 'registered occupant', 'weather alert'],  ['battery limit', 'main gate', 'family member'],  ['push notification', 'notification', 'voice command'],  ['movie suggestion', 'new movie', 'new product'],  ['outdoor motion detector', 'hallway motion detector'],  ['text', 'text message', 'nfc'],  ['wireless charger',  'personal preference',  'socket adapter',  'audio listening'],  ['app', 'stovetops', 'device', 'smartphone', 'window'],  ['recommendation',  'occurs',  'anything',  'anyone',  'shock',  'sound',  'tv',  'etc',  'something',  'intruder',  'optimal',  'music',  'television',  'greets'],  ['big saving', 'potential weather issue', 'respiratory issue']] K=66 [['recommendation'],  ['home turn', 'full home sport', 'home safety', 'home air'],  ['favorite show', 'movie suggestion', 'new movie', 'new product'],  ['nfc'],  ['pet water container'],  ['long day', 'day benefit'],  ['window sensor', 'mobile phone', 'video camera', 'window fan'],  ['smart device',  'smart thermostat',  'smart home',  'smart home',  'smart feature'],  ['packaging information', 'relevant information'],  ['push notification'],  ['package delivery'],  ['regular furnace', 'registered occupant'],  ['appropriate time', 'different time', 'lunch time'],  ['smart shower',  'smart electronics',  'smart lock',  'smart coffee machine',  'smart breakfast appliance'],  ['remote'],  ['sound', 'tv', 'music', 'television'],  ['carbon monoxide', 'carbon monoxide detector'],  ['sensor', 'temprature'],  ['outdoor safety light'],  ['other thing',  'plant soil',  'teenage child',  'child nears',  'optimal condition'],  ['air purity controller', 'ductless heat pump', 'air quality', 'heat source'],  ['ideal temperature'],  ['dangerous place', 'such place'],  ['anything', 'anyone', 'stovetops', 'greets'],  ['something'],  ['integrated roomba vacuum'],  ['order delivery food'],  ['app', 'smartphone', 'window'],  ['auto sprinkler',  'automatic fragrance sprinkler',  'pleasant mood everytime'],  ['food bowl'],  ['nice walk today', 'young child movement'],  ['biorhythm app', 'radio system', 'smartwatch application', 'central system'],  ['voice command', 'audio listening', 'background music'],  ['food preparation', 'breakfast food'],  ['socket adapter'],  ['appliance', 'electricity', 'thermostat'],  ['device'],  ['occurs', 'optimal'],  ['hallway motion detector'],  ['snow high wind'],  ['kitchen item', 'class reminder', 'scheduled timing'],  ['text', 'text message'],  ['energy use', 'energy consumption'],  ['energy bill', 'energy cost'],  ['house simultaneously party', 'party guest'],  ['wireless charger', 'personal preference'],  ['heater'],  ['baby room', 'single room', 'room lighting', 'lighting'],  ['team goal', 'health goal'],  ['shower', 'etc', 'intruder'],  ['certain light', 'weather adjustment', 'weather alert'],  ['door', 'shock', 'lock'],  ['notification'],  ['outdoor motion detector', 'outdoor motion sensor'],  ['smart carbon monoxide detector'],  ['minimum required amount'],  ['battery limit', 'limit benefit'],  ['main gate', 'added measure', 'family member'],  ['remote control opener', 'remote location', 'garage door'],  ['space heater', 'ceiling fan'],  ['outside temperature', 'desired temperature', 'optimal temperature'],  ['potential health concern', 'potential weather issue', 'overall health'],  ['dangerous gas'],  ['big saving'],  ['good night', 'night sleep', 'good way'],  ['easy status update', 'respiratory issue']] |
| EM + WordNet removal + similarity matrix formed using FastText trained on homeautomation Wikipedia corpora |  | K=23 [['recommendation', 'occurs', 'optimal', 'nfc'],  ['favorite show',  'movie suggestion',  'new movie',  'push notification',  'new product',  'background music'],  ['big saving',  'kitchen item',  'wireless charger',  'minimum required amount',  'socket adapter',  'nice walk today',  'voice command',  'audio listening',  'regular furnace',  'party guest',  'text message'],  ['smart shower',  'smart electronics',  'smart device',  'smart lock',  'smart thermostat',  'smart home',  'smart home',  'smart feature'],  ['house simultaneously party',  'snow high wind',  'air purity controller',  'ductless heat pump',  'air quality',  'remote control opener',  'pet water container',  'automatic fragrance sprinkler',  'pleasant mood everytime',  'ceiling fan',  'integrated roomba vacuum'],  ['outside temperature',  'desired temperature',  'optimal condition',  'ideal temperature',  'heat source',  'optimal temperature'],  ['anything',  'door',  'anyone',  'shock',  'shower',  'notification',  'etc',  'something',  'intruder',  'sensor',  'temprature',  'window',  'greets'],  ['energy use', 'energy bill', 'energy cost', 'energy consumption'],  ['home turn', 'full home sport', 'certain light', 'home safety', 'home air'],  ['biorhythm app',  'radio system',  'window sensor',  'different time',  'mobile phone',  'smart coffee machine',  'video camera',  'smart breakfast appliance',  'device',  'window fan',  'smartwatch application',  'remote location',  'central system'],  ['plant soil', 'dangerous place', 'such place', 'dangerous gas'],  ['outdoor motion detector',  'smart carbon monoxide detector',  'carbon monoxide',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light',  'carbon monoxide detector'],  ['appliance',  'stovetops',  'electricity',  'heater',  'smartphone',  'thermostat',  'lighting'],  ['text', 'sound', 'tv', 'remote', 'app', 'music', 'television', 'lock'],  ['baby room',  'single room',  'space heater',  'room lighting',  'garage door',  'lunch time'],  ['package delivery', 'packaging information', 'relevant information'],  ['battery limit',  'appropriate time',  'long day',  'limit benefit',  'day benefit'],  ['order delivery food', 'food preparation', 'breakfast food', 'food bowl'],  ['potential health concern',  'health goal',  'respiratory issue',  'overall health'],  ['good night', 'night sleep', 'good way'],  ['main gate',  'personal preference',  'class reminder',  'added measure',  'family member',  'auto sprinkler',  'scheduled timing',  'team goal',  'easy status update',  'registered occupant'],  ['teenage child', 'child nears', 'young child movement'],  ['other thing',  'weather adjustment',  'potential weather issue',  'weather alert']] K=41 [['appliance', 'electricity', 'heater', 'lighting'],  ['remote control opener', 'remote location'],  ['snow high wind', 'pet water container', 'integrated roomba vacuum'],  ['smart shower', 'smart device', 'smart home', 'smart home'],  ['anything', 'anyone', 'stovetops', 'etc', 'something', 'greets'],  ['kitchen item', 'wireless charger', 'socket adapter', 'nice walk today'],  ['favorite show', 'push notification', 'new product', 'voice command'],  ['ductless heat pump',  'minimum required amount',  'space heater',  'regular furnace',  'heat source'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['recommendation', 'sound', 'tv', 'television'],  ['outside temperature',  'desired temperature',  'ideal temperature',  'optimal temperature'],  ['radio system',  'mobile phone',  'video camera',  'device',  'smartwatch application',  'central system'],  ['food preparation', 'breakfast food', 'food bowl'],  ['potential health concern', 'health goal', 'overall health'],  ['energy use', 'energy bill', 'energy cost', 'energy consumption'],  ['appropriate time', 'different time', 'lunch time'],  ['window sensor', 'window fan', 'ceiling fan', 'window'],  ['door', 'remote', 'garage door', 'lock'],  ['team goal', 'good way'],  ['dangerous place', 'such place', 'dangerous gas'],  ['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light'],  ['big saving',  'easy status update',  'potential weather issue',  'respiratory issue'],  ['teenage child', 'child nears', 'young child movement'],  ['plant soil',  'auto sprinkler',  'scheduled timing',  'automatic fragrance sprinkler',  'pleasant mood everytime'],  ['occurs', 'text', 'shock', 'shower', 'intruder', 'nfc'],  ['battery limit', 'limit benefit', 'day benefit'],  ['smart electronics',  'smart lock',  'smart coffee machine',  'smart thermostat',  'smart breakfast appliance',  'smart feature'],  ['audio listening', 'music', 'background music'],  ['optimal condition', 'optimal'],  ['sensor', 'thermostat', 'temprature'],  ['home turn', 'full home sport', 'certain light', 'home safety', 'home air'],  ['biorhythm app', 'notification', 'app', 'smartphone'],  ['packaging information', 'relevant information'],  ['good night', 'night sleep', 'long day'],  ['other thing', 'weather adjustment', 'weather alert'],  ['house simultaneously party',  'personal preference',  'family member',  'party guest'],  ['main gate',  'class reminder',  'added measure',  'registered occupant',  'text message'],  ['baby room', 'single room', 'room lighting'],  ['air purity controller', 'air quality'],  ['movie suggestion', 'new movie'],  ['order delivery food', 'package delivery']] K= 54 [['stovetops'],  ['long day', 'limit benefit', 'day benefit'],  ['smart electronics',  'smart lock',  'smart coffee machine',  'smart thermostat',  'smart breakfast appliance',  'smart feature'],  ['radio system', 'central system'],  ['house simultaneously party', 'party guest'],  ['certain light'],  ['wireless charger', 'socket adapter'],  ['energy use', 'energy bill', 'energy cost', 'energy consumption'],  ['favorite show', 'new product'],  ['outdoor motion detector',  'hallway motion detector',  'outdoor motion sensor',  'outdoor safety light'],  ['other thing', 'weather adjustment', 'weather alert'],  ['nfc'],  ['outside temperature',  'desired temperature',  'ideal temperature',  'optimal temperature'],  ['ductless heat pump', 'pet water container', 'heat source'],  ['music', 'background music'],  ['dangerous place', 'such place', 'dangerous gas'],  ['easy status update', 'potential weather issue', 'respiratory issue'],  ['window sensor', 'window fan', 'ceiling fan'],  ['recommendation'],  ['order delivery food', 'food preparation', 'breakfast food', 'food bowl'],  ['air purity controller', 'air quality', 'remote control opener'],  ['appropriate time', 'different time', 'lunch time'],  ['personal preference',  'scheduled timing',  'voice command',  'audio listening'],  ['good night', 'night sleep', 'good way'],  ['home turn', 'full home sport', 'home safety', 'home air'],  ['occurs', 'shock', 'intruder', 'greets'],  ['movie suggestion', 'new movie'],  ['baby room', 'single room', 'room lighting'],  ['text', 'text message'],  ['door', 'garage door', 'lock'],  ['auto sprinkler',  'automatic fragrance sprinkler',  'pleasant mood everytime',  'integrated roomba vacuum'],  ['smart carbon monoxide detector',  'carbon monoxide',  'carbon monoxide detector'],  ['sound', 'tv', 'television'],  ['package delivery', 'packaging information'],  ['snow high wind',  'big saving',  'minimum required amount',  'nice walk today'],  ['kitchen item', 'class reminder', 'relevant information'],  ['appliance', 'electricity', 'lighting'],  ['young child movement'],  ['smartphone', 'sensor', 'window'],  ['plant soil', 'regular furnace', 'registered occupant'],  ['smart shower', 'smart device', 'smart home', 'smart home'],  ['thermostat', 'temprature'],  ['push notification', 'notification'],  ['shower', 'etc'],  ['optimal condition', 'optimal'],  ['teenage child', 'child nears'],  ['biorhythm app', 'app'],  ['potential health concern', 'team goal', 'health goal', 'overall health'],  ['anything', 'anyone', 'something'],  ['mobile phone', 'video camera', 'smartwatch application'],  ['remote', 'remote location'],  ['space heater', 'heater'],  ['battery limit', 'main gate', 'added measure', 'family member'],  ['device']] |
| KM + without WordNet removal + similarity matrix formed using pretrained on wikinews FastText |  | K=38 [['energy bill',  'energy consumption',  'energy use',  'energy cost',  'breakfast food',  'food preparation',  'food bowl'],  ['voice command',  'audio listening',  'window fan',  'socket adapter',  'video camera',  'garage door',  'biorhythm app',  'radio system',  'wireless charger',  'mobile phone',  'smartwatch application',  'window sensor',  'auto sprinkler',  'ceiling fan'],  ['table', 'lock', 'picture', 'box'],  ['temperature'],  ['mood',  'harm',  'need',  'optimal',  'convenient',  'amount',  'money',  'light',  'ability',  'shock',  'sound',  'care',  'experience',  'anything',  'something',  'habit'],  ['weather adjustment', 'potential weather issue', 'weather alert'],  ['system',  'school',  'home',  'vehicle',  'car',  'house',  'remote',  'location',  'plant',  'area',  'body',  'family',  'stock',  'property'],  ['air quality', 'home air', 'home turn', 'home safety', 'room lighting'],  ['use',  'combination',  'source',  'work',  'activity',  'feed',  'effect',  'type',  'control',  'object'],  ['class reminder',  'package delivery',  'text message',  'push notification',  'movie suggestion',  'scheduled timing',  'added measure'],  ['minimum required amount',  'smart coffee machine',  'nice walk today',  'full home sport',  'smart breakfast appliance',  'easy status update',  'potential health concern',  'order delivery food',  'remote control opener',  'pleasant mood everytime'],  ['hobby', 'animal', 'dog', 'pet', 'robot'],  ['heater', 'stove', 'oven', 'toaster', 'stovetops', 'thermostat'],  ['team goal', 'overall health', 'health goal'],  ['fire',  'security',  'safety',  'energy',  'comfort',  'emergency',  'food',  'air',  'environment',  'water'],  ['tablet',  'device',  'smartphone',  'battery',  'appliance',  'detector',  'sensor',  'smart',  'app'],  ['different time',  'day benefit',  'night sleep',  'lunch time',  'good night',  'appropriate time',  'long day'],  ['ir', 'ac', 'nfc'],  ['smart device',  'smart shower',  'smart thermostat',  'smart home',  'smart feature',  'smart electronics',  'smart lock',  'smart home'],  ['outdoor', 'indoor', 'lighting'],  ['occurs',  'notification',  'photo',  'label',  'text',  'gesture',  'recommendation',  'volume'],  ['video', 'guest', 'music', 'television', 'news'],  ['coffee', 'teeth', 'vegetable', 'fruit'],  ['dinner', 'year', 'morning', 'day', 'night', 'while', 'minute', 'chore'],  ['doorbell',  'wall',  'window',  'room',  'bed',  'bedroom',  'door',  'garage',  'doorstep',  'shower',  'floor',  'sink'],  ['date',  'time',  'show',  'save',  'play',  'start',  'case',  'adjust',  'match',  'cut',  'issue',  'turn',  'one'],  ['update', 'distance', 'order', 'class', 'schedule', 'bill'],  ['registered occupant',  'baby room',  'child nears',  'young child movement',  'family member',  'teenage child'],  ['greets', 'dusk', 'tv', 'bracelet', 'welcome', 'etc'],  ['new movie',  'kitchen item',  'main gate',  'new product',  'favorite show',  'party guest',  'background music',  'central system',  'big saving',  'single room',  'regular furnace'],  ['anyone',  'people',  'kid',  'doctor',  'person',  'nobody',  'baby',  'child',  'dentist',  'someone'],  ['personal preference',  'optimal condition',  'heat source',  'battery limit',  'packaging information',  'limit benefit',  'respiratory issue',  'relevant information',  'certain light'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide',  'monoxide'],  ['alert', 'trespasser', 'police', 'alarm', 'incase', 'intruder', 'theft'],  ['outside temperature',  'ideal temperature',  'optimal temperature',  'plant soil',  'space heater',  'desired temperature',  'dangerous gas'],  ['outdoor motion sensor',  'outdoor safety light',  'snow high wind',  'ductless heat pump',  'integrated roomba vacuum',  'house simultaneously party',  'outdoor motion detector',  'air purity controller',  'pet water container',  'hallway motion detector',  'automatic fragrance sprinkler'],  ['weather',  'pollution',  'disturbance',  'electricity',  'vacuum',  'temprature',  'carbon'],  ['other thing',  'remote location',  'such place',  'dangerous place',  'good way']] K= 68 [['morning', 'day', 'night'],  ['greets', 'dusk', 'etc'],  ['smart coffee machine',  'smart shower',  'smart breakfast appliance',  'smart thermostat'],  ['alert', 'alarm', 'disturbance', 'shock'],  ['outside temperature',  'ideal temperature',  'heat source',  'optimal temperature',  'desired temperature'],  ['outdoor', 'indoor'],  ['carbon', 'monoxide'],  ['home air', 'home turn', 'home safety'],  ['tablet', 'smartphone', 'photo', 'battery', 'label', 'bracelet', 'app'],  ['save', 'order', 'start', 'need', 'turn'],  ['year', 'while', 'minute'],  ['animal', 'baby', 'family', 'dog', 'pet', 'child'],  ['potential health concern', 'order delivery food', 'pet water container'],  ['security', 'safety', 'emergency', 'environment'],  ['comfort', 'care'],  ['guest', 'kid', 'doctor', 'dentist'],  ['teeth',  'occurs',  'mood',  'harm',  'hobby',  'gesture',  'ability',  'smart',  'habit',  'chore'],  ['pollution', 'energy', 'theft'],  ['stove', 'stovetops'],  ['coffee', 'doorbell', 'appliance', 'detector', 'sensor', 'toaster', 'robot'],  ['window fan',  'baby room',  'garage door',  'single room',  'window sensor',  'room lighting'],  ['registered occupant',  'full home sport',  'party guest',  'house simultaneously party'],  ['smart device', 'smart feature', 'smart electronics', 'smart lock'],  ['night sleep', 'long day'],  ['weather adjustment',  'potential weather issue',  'weather alert',  'respiratory issue',  'scheduled timing'],  ['system', 'combination', 'device', 'source', 'type', 'control', 'object'],  ['show', 'picture'],  ['use', 'work', 'activity', 'experience'],  ['minimum required amount',  'nice walk today',  'easy status update',  'snow high wind',  'ductless heat pump',  'remote control opener',  'pleasant mood everytime',  'integrated roomba vacuum',  'air purity controller',  'automatic fragrance sprinkler'],  ['class reminder', 'text message', 'push notification', 'movie suggestion'],  ['table', 'bill'],  ['dinner', 'bed', 'floor'],  ['heater'],  ['plant', 'food', 'vegetable'],  ['home', 'room', 'bedroom', 'garage', 'house'],  ['welcome'],  ['child nears', 'young child movement', 'family member', 'teenage child'],  ['ir', 'ac', 'nfc'],  ['outdoor motion detector', 'hallway motion detector'],  ['other thing',  'different time',  'day benefit',  'such place',  'certain light',  'dangerous place',  'lunch time',  'good night',  'appropriate time',  'good way'],  ['window', 'door', 'doorstep'],  ['case', 'effect', 'issue', 'something', 'one'],  ['anyone', 'nobody', 'anything', 'someone'],  ['breakfast food', 'food preparation', 'food bowl'],  ['shower', 'cut', 'vacuum', 'sink'],  ['trespasser', 'police', 'intruder'],  ['text', 'amount', 'volume'],  ['date', 'match', 'class', 'schedule'],  ['fire', 'electricity', 'lighting'],  ['feed', 'money', 'fruit', 'stock'],  ['notification', 'update', 'incase', 'adjust', 'recommendation', 'news'],  ['light', 'sound'],  ['people', 'person'],  ['air', 'water'],  ['tv', 'oven', 'thermostat'],  ['personal preference',  'team goal',  'optimal condition',  'battery limit',  'packaging information',  'limit benefit',  'overall health',  'relevant information',  'big saving',  'health goal',  'added measure'],  ['new movie',  'kitchen item',  'main gate',  'package delivery',  'new product',  'voice command',  'remote location',  'favorite show',  'background music',  'central system',  'radio system',  'smartwatch application',  'space heater',  'regular furnace'],  ['wall', 'lock', 'box'],  ['video', 'music', 'play', 'television'],  ['temperature', 'weather', 'temprature'],  ['air quality',  'plant soil',  'energy bill',  'energy consumption',  'energy use',  'energy cost',  'dangerous gas'],  ['audio listening',  'socket adapter',  'video camera',  'biorhythm app',  'wireless charger',  'mobile phone',  'auto sprinkler',  'ceiling fan'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide'],  ['outdoor motion sensor', 'outdoor safety light'],  ['smart home', 'smart home'],  ['school', 'vehicle', 'car', 'area', 'body', 'property'],  ['distance', 'optimal', 'convenient', 'remote', 'location'],  ['time']] K=97 [['doorbell', 'bracelet'],  ['battery', 'appliance', 'detector', 'sensor'],  ['new movie',  'main gate',  'new product',  'favorite show',  'movie suggestion',  'regular furnace'],  ['pollution', 'energy', 'electricity', 'water'],  ['plant', 'vegetable', 'fruit'],  ['plant soil',  'socket adapter',  'auto sprinkler',  'automatic fragrance sprinkler'],  ['ceiling fan'],  ['distance', 'light', 'remote'],  ['table', 'window', 'door', 'box'],  ['registered occupant', 'party guest'],  ['issue'],  ['wall', 'doorstep', 'floor'],  ['outdoor', 'indoor', 'lighting'],  ['teeth', 'greets', 'dentist'],  ['while'],  ['vacuum', 'carbon'],  ['tablet'],  ['kitchen item', 'baby room', 'single room', 'room lighting'],  ['minimum required amount',  'nice walk today',  'potential weather issue',  'easy status update',  'snow high wind',  'pleasant mood everytime'],  ['control'],  ['night sleep'],  ['window fan', 'garage door', 'window sensor'],  ['weather'],  ['kid', 'baby', 'child'],  ['outside temperature',  'ideal temperature',  'heat source',  'optimal temperature',  'space heater',  'desired temperature'],  ['anything', 'something'],  ['energy bill',  'energy consumption',  'energy use',  'energy cost',  'dangerous gas'],  ['fire', 'emergency', 'stock'],  ['smart home', 'smart home'],  ['oven', 'toaster'],  ['trespasser', 'intruder', 'theft'],  ['activity', 'comfort', 'care', 'experience'],  ['start', 'turn'],  ['home turn'],  ['breakfast food', 'food preparation', 'food bowl'],  ['tv', 'etc'],  ['thermostat'],  ['child nears'],  ['air quality', 'weather adjustment'],  ['year', 'morning', 'day', 'night', 'minute'],  ['smart device', 'smart feature', 'smart electronics', 'smart lock'],  ['dog', 'pet', 'robot'],  ['temperature', 'temprature'],  ['work'],  ['ir', 'ac', 'nfc'],  ['background music'],  ['video', 'show', 'music', 'play', 'television', 'news'],  ['home air', 'home safety'],  ['family member', 'teenage child'],  ['full home sport', 'house simultaneously party'],  ['occurs', 'alert', 'incase'],  ['dusk', 'monoxide'],  ['other thing',  'different time',  'such place',  'relevant information',  'big saving',  'certain light',  'dangerous place',  'appropriate time',  'good way'],  ['personal preference',  'optimal condition',  'limit benefit',  'overall health',  'potential health concern',  'health goal'],  ['heater', 'stove'],  ['anyone', 'nobody', 'welcome', 'someone'],  ['ability'],  ['class reminder',  'voice command',  'text message',  'weather alert',  'respiratory issue'],  ['date', 'time', 'update', 'order', 'match', 'schedule'],  ['animal', 'food'],  ['school', 'home', 'family'],  ['stovetops'],  ['person', 'one'],  ['save', 'need', 'adjust', 'cut'],  ['recommendation', 'bill'],  ['biorhythm app',  'wireless charger',  'mobile phone',  'smartwatch application'],  ['case', 'picture', 'object'],  ['garage'],  ['central system', 'radio system'],  ['alarm', 'harm', 'disturbance', 'shock', 'shower', 'sound'],  ['people'],  ['lock', 'sink'],  ['optimal', 'convenient'],  ['gesture'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide'],  ['security', 'safety', 'air', 'environment'],  ['notification', 'photo', 'label', 'text', 'volume'],  ['system', 'device', 'vehicle', 'car', 'body', 'property'],  ['money'],  ['room', 'bed', 'bedroom', 'house'],  ['smart coffee machine',  'smart shower',  'smart breakfast appliance',  'smart thermostat'],  ['smartphone', 'app'],  ['feed'],  ['day benefit', 'lunch time', 'good night', 'long day'],  ['ductless heat pump',  'order delivery food',  'remote control opener',  'integrated roomba vacuum',  'air purity controller',  'pet water container'],  ['class', 'location', 'area'],  ['audio listening', 'video camera'],  ['hallway motion detector'],  ['use', 'combination', 'source', 'effect', 'type'],  ['package delivery',  'team goal',  'remote location',  'battery limit',  'push notification',  'packaging information',  'scheduled timing',  'added measure'],  ['outdoor motion sensor', 'outdoor safety light', 'outdoor motion detector'],  ['young child movement'],  ['mood'],  ['police', 'doctor'],  ['amount'],  ['hobby', 'smart', 'habit', 'chore'],  ['coffee', 'dinner', 'guest']] |
| EM + without WordNet removal + similarity matrix formed using pretrained on wikinews FastText |  | K=48 [['personal preference',  'class reminder',  'package delivery',  'voice command',  'text message',  'push notification',  'packaging information',  'respiratory issue',  'relevant information',  'background music',  'movie suggestion',  'added measure'],  ['security',  'safety',  'emergency',  'food',  'environment',  'control',  'stock',  'property'],  ['notification', 'update', 'gesture', 'recommendation', 'bill', 'chore'],  ['socket adapter',  'snow high wind',  'ductless heat pump',  'pleasant mood everytime',  'integrated roomba vacuum',  'house simultaneously party',  'air purity controller',  'auto sprinkler',  'automatic fragrance sprinkler'],  ['video', 'photo', 'label', 'text', 'picture', 'news'],  ['ir', 'ac', 'nfc'],  ['tv', 'etc'],  ['table', 'wall', 'window', 'door', 'lock', 'box'],  ['date',  'time',  'show',  'save',  'play',  'order',  'start',  'adjust',  'match',  'cut',  'minute',  'schedule',  'turn'],  ['other thing',  'favorite show',  'different time',  'limit benefit',  'day benefit',  'such place',  'night sleep',  'big saving',  'certain light',  'dangerous place',  'lunch time',  'good night',  'appropriate time',  'long day',  'good way'],  ['coffee', 'vegetable', 'fruit'],  ['new movie',  'main gate',  'new product',  'remote location',  'central system',  'radio system',  'regular furnace'],  ['teeth', 'guest', 'police', 'kid', 'doctor', 'dentist'],  ['distance', 'energy', 'amount', 'money', 'ability', 'volume'],  ['temperature',  'weather',  'heater',  'pollution',  'disturbance',  'electricity',  'vacuum',  'temprature'],  ['plant soil', 'breakfast food', 'pet water container', 'food bowl'],  ['year', 'morning', 'day', 'night'],  ['smart home', 'smart home'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide'],  ['anyone', 'people', 'nobody', 'someone'],  ['fire', 'air', 'water'],  ['team goal',  'registered occupant',  'baby room',  'party guest',  'child nears',  'young child movement',  'family member',  'teenage child'],  ['stove', 'oven', 'carbon', 'toaster', 'stovetops', 'thermostat', 'monoxide'],  ['use', 'need', 'feed', 'comfort', 'care', 'experience', 'person', 'body'],  ['minimum required amount',  'potential weather issue',  'full home sport',  'easy status update',  'outdoor safety light',  'potential health concern',  'order delivery food',  'remote control opener'],  ['mood',  'music',  'optimal',  'convenient',  'light',  'shock',  'sound',  'remote',  'lighting',  'habit'],  ['hobby', 'animal', 'baby', 'dog', 'pet', 'child'],  ['air quality',  'battery limit',  'energy bill',  'overall health',  'energy consumption',  'energy use',  'energy cost',  'health goal',  'food preparation',  'dangerous gas'],  ['combination',  'source',  'work',  'activity',  'case',  'effect',  'location',  'type',  'issue',  'one',  'object'],  ['system', 'device', 'vehicle', 'sensor'],  ['smart coffee machine', 'nice walk today', 'smart breakfast appliance'],  ['smart device',  'smart shower',  'smart thermostat',  'smart feature',  'smart electronics',  'smart lock'],  ['outside temperature',  'optimal condition',  'ideal temperature',  'heat source',  'optimal temperature',  'space heater',  'desired temperature'],  ['occurs', 'alert', 'incase', 'while'],  ['kitchen item',  'audio listening',  'video camera',  'biorhythm app',  'wireless charger',  'mobile phone',  'smartwatch application'],  ['outdoor', 'indoor', 'television'],  ['home air', 'home turn', 'home safety'],  ['dinner', 'bed', 'bedroom', 'garage', 'doorstep', 'shower', 'floor', 'sink'],  ['home', 'room', 'car', 'house'],  ['weather adjustment', 'weather alert', 'scheduled timing'],  ['doorbell', 'trespasser', 'alarm', 'intruder', 'detector', 'theft'],  ['harm', 'anything', 'something'],  ['outdoor motion sensor',  'outdoor motion detector',  'hallway motion detector'],  ['smart'],  ['greets', 'dusk', 'bracelet', 'welcome'],  ['window fan',  'garage door',  'single room',  'window sensor',  'room lighting',  'ceiling fan'],  ['tablet', 'smartphone', 'battery', 'appliance', 'app', 'robot'],  ['school', 'class', 'plant', 'area', 'family']] K=94 [['greets', 'welcome'],  ['voice command', 'audio listening', 'video camera', 'background music'],  ['money', 'comfort', 'care', 'person'],  ['main gate', 'central system', 'regular furnace'],  ['date',  'table',  'show',  'update',  'play',  'start',  'adjust',  'match',  'schedule'],  ['nice walk today', 'easy status update', 'pleasant mood everytime'],  ['pollution', 'carbon'],  ['room', 'bed', 'bedroom', 'garage'],  ['ac'],  ['heater', 'stove', 'toaster', 'stovetops'],  ['anyone', 'people', 'nobody', 'someone'],  ['fire', 'light', 'electricity', 'lighting'],  ['outside temperature',  'optimal condition',  'ideal temperature',  'optimal temperature',  'desired temperature'],  ['tablet', 'smartphone', 'app', 'robot'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide'],  ['air quality', 'heat source'],  ['order', 'case', 'effect', 'issue', 'one'],  ['animal', 'dog', 'pet'],  ['full home sport', 'house simultaneously party'],  ['night sleep'],  ['smart device',  'smart shower',  'smart thermostat',  'smart feature',  'smart electronics',  'smart lock'],  ['distance', 'remote', 'location', 'area'],  ['plant soil', 'breakfast food', 'food preparation', 'food bowl'],  ['personal preference', 'team goal', 'overall health', 'health goal'],  ['time', 'morning', 'day', 'night'],  ['kitchen item', 'baby room', 'single room', 'space heater', 'room lighting'],  ['minimum required amount',  'snow high wind',  'ductless heat pump',  'automatic fragrance sprinkler'],  ['other thing',  'remote location',  'such place',  'relevant information',  'certain light',  'dangerous place',  'good way'],  ['wall', 'window', 'door', 'lock', 'doorstep', 'floor', 'box'],  ['tv'],  ['mood', 'sound', 'habit'],  ['energy bill',  'energy consumption',  'energy use',  'energy cost',  'dangerous gas'],  ['video', 'music', 'television', 'news'],  ['police', 'doctor', 'dentist'],  ['outdoor', 'indoor'],  ['socket adapter', 'wireless charger', 'mobile phone', 'auto sprinkler'],  ['system', 'device'],  ['nfc'],  ['child nears', 'young child movement', 'family member', 'teenage child'],  ['label'],  ['security', 'safety', 'emergency'],  ['smart coffee machine', 'smart breakfast appliance'],  ['alert', 'alarm', 'shock'],  ['school', 'class', 'family'],  ['different time', 'lunch time', 'appropriate time'],  ['class reminder', 'text message', 'push notification', 'added measure'],  ['detector', 'sensor'],  ['weather adjustment', 'weather alert'],  ['trespasser', 'intruder', 'theft'],  ['dusk'],  ['optimal', 'convenient'],  ['dinner', 'guest'],  ['occurs'],  ['feed', 'plant', 'stock'],  ['coffee', 'vegetable', 'fruit'],  ['hallway motion detector'],  ['window fan', 'garage door', 'window sensor', 'ceiling fan'],  ['weather'],  ['energy', 'food', 'air', 'water'],  ['etc'],  ['shower', 'sink'],  ['monoxide'],  ['text', 'amount', 'volume'],  ['home air', 'home turn', 'home safety'],  ['home', 'house'],  ['temperature', 'vacuum', 'temprature'],  ['hobby', 'chore'],  ['photo', 'source', 'picture'],  ['smart'],  ['incase', 'anything', 'something'],  ['outdoor motion sensor', 'outdoor safety light', 'outdoor motion detector'],  ['notification', 'recommendation', 'bill'],  ['oven', 'thermostat'],  ['combination', 'type', 'object'],  ['work', 'activity', 'experience', 'environment'],  ['teeth', 'bracelet', 'gesture'],  ['ability'],  ['remote control opener',  'integrated roomba vacuum',  'air purity controller',  'pet water container'],  ['battery limit', 'biorhythm app', 'smartwatch application'],  ['smart home', 'smart home'],  ['registered occupant', 'party guest'],  ['new movie',  'new product',  'favorite show',  'movie suggestion',  'big saving'],  ['battery', 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| KM + without WordNet removal + similarity matrix formed using FastText trained on homeautomation Wikipedia corpora |  | K=37 [['notification', 'show', 'mood', 'music', 'play', 'tv', 'app'],  ['coffee',  'teeth',  'use',  'anyone',  'alert',  'dinner',  'alarm',  'home',  'need',  'shower',  'oven',  'anything',  'fruit',  'toaster',  'stovetops',  'etc',  'something',  'someone',  'one',  'chore'],  ['fire', 'feed', 'television', 'box'],  ['doorbell',  'guest',  'greets',  'door',  'bracelet',  'garage',  'kid',  'doorstep',  'intruder',  'baby',  'dog',  'pet',  'welcome'],  ['potential weather issue', 'respiratory issue', 'issue'],  ['video', 'update', 'device', 'smartphone', 'security', 'window', 'battery'],  ['outside temperature',  'ideal temperature',  'optimal temperature',  'desired temperature'],  ['energy bill',  'energy',  'energy consumption',  'energy use',  'energy cost',  'electricity'],  ['save', 'safety', 'money', 'comfort', 'family', 'bill'],  ['wall',  'distance',  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| EM + without WordNet removal + similarity matrix formed using FastText trained on homeautomation Wikipedia corpora |  | K=45 [['detector', 'carbon', 'monoxide'],  ['energy bill',  'energy',  'energy consumption',  'energy use',  'energy cost',  'electricity'],  ['other thing',  'personal preference',  'class reminder',  'voice command',  'audio listening',  'window fan',  'text message',  'push notification',  'video camera',  'party guest',  'background music',  'biorhythm app',  'scheduled timing',  'added measure',  'auto sprinkler'],  ['safety'],  ['anyone',  'alert',  'show',  'trespasser',  'mood',  'greets',  'doorstep',  'intruder',  'welcome',  'someone',  'one'],  ['occurs', 'case', 'convenient', 'money', 'emergency', 'care'],  ['table',  'wall',  'source',  'pollution',  'optimal',  'amount',  'plant',  'cut',  'vacuum',  'air',  'sink'],  ['central system',  'radio system',  'mobile phone',  'smartwatch application',  'window sensor'],  ['music', 'play', 'tv', 'news', 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['outdoor motion sensor',  'outdoor safety light',  'outdoor motion detector',  'hallway motion detector'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide'],  ['save', 'harm', 'amount', 'money', 'cut', 'bill'],  ['teeth', 'incase', 'oven', 'toaster', 'stovetops'],  ['limit benefit', 'day benefit', 'day', 'long day'],  ['video', 'tablet', 'smartphone', 'window', 'battery'],  ['such place', 'dangerous place', 'dangerous gas'],  ['door', 'garage door', 'garage'],  ['other thing',  'personal preference',  'text message',  'party guest',  'added measure'],  ['wall', 'distance', 'feed'],  ['night sleep', 'night', 'good night'],  ['heat source', 'source', 'ductless heat pump', 'space heater'],  ['energy bill', 'energy', 'energy consumption', 'energy use', 'energy cost'],  ['outside temperature',  'ideal temperature',  'optimal temperature',  'desired temperature'],  ['guest', 'hobby', 'people', 'intruder', 'welcome'],  ['tv', 'television', 'box'],  ['child nears', 'young child movement', 'teenage child', 'child'],  ['potential weather issue'],  ['order delivery food',  'breakfast food',  'food',  'food preparation',  'food bowl'],  ['notification', 'push notification'],  ['baby room', 'single room', 'certain light', 'room lighting'],  ['heater', 'electricity', 'water'],  ['detector', 'carbon', 'monoxide'],  ['minimum required amount',  'nice walk today',  'snow high wind',  'house simultaneously party',  'family member',  'good way'],  ['ir', 'nfc'],  ['remote location', 'remote control opener', 'remote', 'location'],  ['new movie', 'new product', 'favorite show', 'movie suggestion'],  ['temperature', 'nobody', 'temprature'],  ['weather adjustment', 'weather', 'weather alert'],  ['easy status update',  'pleasant mood everytime',  'integrated roomba vacuum',  'auto sprinkler',  'automatic fragrance sprinkler'],  ['vehicle', 'car', 'year', 'theft'],  ['smart device',  'smart coffee machine',  'smart shower',  'smart breakfast appliance',  'smart thermostat',  'smart feature',  'smart electronics',  'smart',  'smart lock'],  ['photo', 'match', 'recommendation'],  ['police', 'safety', 'activity', 'emergency', 'person', 'habit'],  ['news'],  ['pollution', 'plant', 'sink'],  ['occurs', 'combination', 'experience', 'volume'],  ['home', 'full home sport', 'home air', 'home turn', 'home safety'],  ['air quality', 'air', 'air purity controller'],  ['window fan', 'window sensor', 'ceiling fan'],  ['animal', 'body'],  ['outdoor', 'indoor'],  ['mood', 'music', 'play'],  ['work', 'respiratory issue', 'issue'],  ['fire', 'stove'],  ['house', 'light', 'adjust', 'turn', 'etc'],  ['date', 'label', 'stock'],  ['coffee', 'use', 'dinner', 'chore'],  ['vacuum', 'floor', 'robot'],  ['show', 'shower'],  ['school', 'bed', 'kid', 'dentist'],  ['class reminder', 'class'],  ['doorbell', 'alert', 'alarm', 'sound', 'minute'],  ['table', 'vegetable', 'fruit'],  ['package delivery', 'packaging information', 'relevant information'],  ['main gate',  'battery limit',  'socket adapter',  'wireless charger',  'scheduled timing'],  ['start', 'comfort', 'ac', 'schedule'],  ['case', 'family', 'property'],  ['need', 'morning', 'baby', 'anything', 'something'],  ['optimal condition', 'optimal'],  ['central system', 'radio system'],  ['kitchen item',  'registered occupant',  'plant soil',  'big saving',  'regular furnace'],  ['text', 'gesture', 'lock', 'picture', 'shock', 'while'],  ['order'],  ['update', 'security', 'app']] K=139 [['energy bill', 'energy consumption', 'energy use', 'energy cost'],  ['shock'],  ['easy status update'],  ['main gate', 'socket adapter', 'scheduled timing'],  ['mood', 'adjust'],  ['need'],  ['smart device',  'smart shower',  'smart thermostat',  'smart feature',  'smart electronics',  'smart lock'],  ['table'],  ['theft'],  ['environment', 'object'],  ['kitchen item'],  ['home air', 'home turn', 'home safety'],  ['pleasant mood everytime',  'integrated roomba vacuum',  'auto sprinkler',  'automatic fragrance sprinkler'],  ['dog', 'pet', 'chore'],  ['heater', 'water'],  ['wireless charger'],  ['outside temperature',  'ideal temperature',  'optimal temperature',  'desired temperature'],  ['doorbell', 'door', 'garage'],  ['outdoor motion sensor',  'outdoor safety light',  'outdoor motion detector',  'hallway motion detector'],  ['team goal', 'overall health', 'potential health concern', 'health goal'],  ['night sleep', 'night', 'good night'],  ['cut'],  ['video', 'video camera', 'mobile phone'],  ['different time', 'lunch time', 'appropriate time'],  ['alert', 'alarm', 'sound'],  ['experience'],  ['baby room', 'single room', 'room lighting'],  ['registered occupant', 'added measure'],  ['detector', 'carbon', 'monoxide'],  ['recommendation'],  ['work', 'schedule'],  ['package delivery'],  ['device'],  ['day'],  ['carbon monoxide detector',  'smart carbon monoxide detector',  'carbon monoxide'],  ['tv', 'television'],  ['vehicle', 'car'],  ['anyone', 'greets', 'doorstep', 'intruder', 'someone', 'one'],  ['heat source',  'ductless heat pump',  'pet water container',  'regular furnace'],  ['outdoor', 'indoor'],  ['battery', 'battery limit', 'limit benefit'],  ['update', 'app'],  ['wall', 'vacuum', 'floor', 'robot'],  ['packaging information', 'relevant information'],  ['new product'],  ['optimal condition', 'optimal'],  ['child nears', 'young child movement', 'teenage child'],  ['house'],  ['smart coffee machine', 'smart breakfast appliance'],  ['family', 'family member'],  ['save', 'money', 'bill'],  ['text message', 'text'],  ['baby', 'anything', 'something'],  ['occurs', 'volume'],  ['central system', 'radio system', 'smartwatch application'],  ['order delivery food',  'breakfast food',  'food',  'food preparation',  'food bowl'],  ['weather adjustment', 'weather', 'weather alert'],  ['police', 'emergency', 'care'],  ['plant soil', 'plant'],  ['hobby', 'ability', 'doctor', 'dentist'],  ['temperature', 'nobody', 'temprature'],  ['dusk'],  ['music', 'play', 'background music'],  ['such place', 'dangerous place', 'dangerous gas'],  ['guest', 'party guest', 'house simultaneously party'],  ['air quality', 'air purity controller'],  ['type'],  ['home'],  ['energy', 'electricity'],  ['window sensor'],  ['fire', 'stove', 'oven'],  ['remote'],  ['photo', 'gesture', 'comfort', 'picture', 'minute'],  ['people', 'year'],  ['amount'],  ['respiratory issue', 'issue'],  ['label', 'stock'],  ['remote location', 'remote control opener', 'location'],  ['vegetable', 'fruit'],  ['new movie', 'favorite show', 'movie suggestion'],  ['convenient'],  ['window fan', 'space heater', 'ceiling fan'],  ['school'],  ['minimum required amount',  'nice walk today',  'snow high wind',  'big saving'],  ['area'],  ['habit'],  ['light', 'lighting', 'turn'],  ['ir', 'nfc'],  ['pollution'],  ['potential weather issue'],  ['day benefit', 'long day'],  ['disturbance'],  ['order'],  ['thermostat'],  ['time'],  ['appliance'],  ['bed'],  ['teeth', 'dinner', 'incase', 'toaster', 'stovetops'],  ['tablet'],  ['room', 'bedroom'],  ['smart home', 'smart home'],  ['biorhythm app'],  ['security'],  ['full home sport'],  ['air'],  ['ac'],  ['class reminder', 'class'],  ['smart'],  ['box'],  ['news'],  ['coffee', 'morning', 'etc'],  ['garage door'],  ['start'],  ['effect'],  ['activity', 'person'],  ['source'],  ['bracelet'],  ['case', 'property'],  ['smartphone', 'window'],  ['sensor'],  ['harm'],  ['use'],  ['good way'],  ['body'],  ['trespasser', 'while', 'welcome'],  ['distance', 'feed'],  ['lock'],  ['other thing', 'personal preference', 'voice command', 'audio listening'],  ['animal'],  ['match'],  ['date'],  ['system', 'control'],  ['certain light'],  ['notification', 'push notification'],  ['show', 'shower'],  ['combination'],  ['safety'],  ['kid', 'child'],  ['sink']] |

**Remark:**

The extracted glossary terms (with/without WordNet removal) are modified (if a term contains more than one ideal glossary term) by splitting into terms present in the ideal cluster for the purpose of evaluation.