Analysis

February 16, 2022

[1]:
```
import pandas as pd
from matplotlib import pyplot as plt
import seaborn as sns
import numpy as np

import csv
from collections import Counter
```

[2]:
```
def distribution(records, question):
    "Get distribution of answers, for a given question."
    c = Counter(record[question] for record in records)
    total = sum(c.values())
    empty = c['']
    counts = {key: {"number": value,
                    "percentage": (value/total) * 100,
                    "percentage_answered": (value/(total-empty)) * 100}
                for key, value in c.items()}
    try:
        del counts['']['percentage_answered']
    except:
        pass
    return counts


def get_questions(question, number):
    "Get questions for a range of questions in a grid."
    texts = []
    for i in range(1,number+1):
        item = f'Q{question}_{i}'
        text = questions[item]
        text = text.split('-')[-1].strip()
        texts.append(text)
    return texts


def get_texts(records, question):
    "Get answer texts."
```

```
    return [answer for record in records
                    if not (answer := record[question]) == ''] # Look at that␣
 ↪cool walrus operator!


def basic_stats(records, question):
    "Print basic statistics about the results."
    counts = distribution(records, question)
    for key, results in counts.items():
        if not key == '':
            print(f"{key}: {results['number']} ({results['percentage_answered']:
 ↪.2f}%)")


def underscored(base, number, records):
    "Get answer distribution for all subquestions."
    results = dict()
    for i in range(1, number+1):
        question = f"Q{base}_{i}"
        results[question] = distribution(records, question)
    return results


def agreement(counts):
    "Select percentage answered for all answers except the empty string."
    results = dict()
    for answer in ['Strongly disagree', 'Somewhat disagree', 'Neither agree nor␣
 ↪disagree', 'Somewhat agree', 'Strongly agree']:
        try:
            results[answer] = counts[answer]['percentage_answered']
        except:
            results[answer] = 0
    return results


def write_texts(texts, filename):
    "Write texts from a list to a file."
    with open('./texts/' + filename,'w') as f:
        writer = csv.writer(f)
        writer.writerows(texts)
```

[3]:
```
df = pd.read_excel("[Distributed] Perceptions of Error Analysis_February 16,␣
 ↪2022_12.47.xlsx")
df = df.fillna('')
records = df.to_dict("records")
```

```
/Users/emiel/opt/anaconda3/lib/python3.8/site-
```

```
packages/openpyxl/styles/stylesheet.py:221: UserWarning: Workbook contains no
default style, apply openpyxl's default
  warn("Workbook contains no default style, apply openpyxl's default")
```

[4]:
```
consented = [record for record in records if str(record['Q1 ']).
 ↪startswith("Yes")]

# For subgroup analysis:
academia = [record for record in records if str(record['Q2'])=='Academia']
industry = [record for record in records if str(record['Q2'])=='Industry']
```

[5]:
```
# If necessary, here are all questions:
questions = records[0]
```

[6]:
```
questions
```

[6]:
```
{'StartDate': 'Start Date',
 'EndDate': 'End Date',
 'Status': 'Response Type',
 'Progress': 'Progress',
 'Duration (in seconds)': 'Duration (in seconds)',
 'Finished': 'Finished',
 'RecordedDate': 'Recorded Date',
 'ResponseId': 'Response ID',
 'DistributionChannel': 'Distribution Channel',
 'UserLanguage': 'User Language',
 'Q1 ': 'Informed consent\n\n \n\nThis is the consent form for our study about
the status of error analysis in NLG. Full details about this study were provided
on the previous page. If you want to read this information again, you can go
back to the previous page. If anything is still unclear about this study, please
contact: C.W.J.vanMiltenburg@tilburguniversity.edu\n\n \n\nConsent\n\nBy
consenting, you indicate that you have read the description on the previous
page, that you are voluntarily taking part in this study, and that you allow for
your data to be processed. This means that:\n\n\n\tYou agree to your responses
being anonymously recorded.\n\tYour answers will be used to study the status of
error analysis in NLG, and may be used in future publications pertaining to this
topic.\n\tThe data will be shared with our research team, with both local (hard
drive) and online (protected cloud drive) backups. This data will be stored
indefinitely, and made public upon completion of our research. Note again that
none of your answers can be traced back to you.\n\tYou acknowledge that there is
no financial compensation for taking part in this study.\n\n\n \n\nNote that you
may still withdraw your consent after completing this form, without any negative
consequences. We will delete all incomplete forms from our study.\n\n \n\nDo you
consent?\n\nDo you agree to take part in this study? If you consent, please
indicate this below by clicking "Yes".  If you click "No", you will be directed
to the end of this questionnaire. You may also close this page to stop
participating in this study.',
```

```
 'Q2': 'Are you in academia or in industry? (If you have a dual affiliation,
please respond with your dominant affiliation in mind.)',
 'Q3': 'How many years have you been working in NLG?',
 'Q4': 'Do you remember reading any NLG papers that include an error analysis?',
 'Q5': 'Did you find the error analyses to be useful?',
 'Q6': "What did you find useful about the error analyses you've seen?",
 'Q7': "Why didn't you find the error analyses to be useful?",
 'Q8': "Is it surprising to you that you haven't seen any published error
analyses? - Selected Choice",
 'Q8_1_TEXT': "Is it surprising to you that you haven't seen any published error
analyses? - Yes, because: - Text",
 'Q8_2_TEXT': "Is it surprising to you that you haven't seen any published error
analyses? - No, because: - Text",
 'Q9': 'Have you ever carried out an error analysis?',
 'Q10': 'What did you find challenging or difficult about carrying out an error
analysis?',
 'Q11': 'Did you feel like there were enough resources/reference material for
you to carry out an error analysis?',
 'Q28': "Do you think you'll carry out an error analysis again in the future?",
 'Q29': 'Could you explain your answer to the previous question?',
 'Q12': 'Have you ever considered carrying out an error analysis?',
 'Q13': "What is the reason you haven't carried out an error analysis?",
 'Q14': 'Are you willing to carry out an error analysis?',
 'Q15': 'For what kinds of papers do you think error analyses may be useful?',
 'Q16_1': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - There was a higher page limit.',
 'Q16_2': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - There would be an existing error taxonomy that I
could use.',
 'Q16_3': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - There would be dedicated annotation tools for
error analysis that I could use.',
 'Q16_4': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - There would be a crowdsourcing template for
carrying out error analyses.',
 'Q16_5': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - Reviewers paid more attention to error
analyses.',
 'Q16_6': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - There were an available pool of annotators or
crowd workers',
 'Q16_7': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - I had more time.',
 'Q16_8': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - I had more money.',
 'Q16_9': 'I would be more likely to carry out an analysis in a
conference/journal paper if… - I had more collaborators.',
```

```
 'Q17': 'Are there any other barriers that prevent you from carrying out an
error analysis?',
 'Q18_1': 'Please indicate whether you agree or disagree with the following
statements - There should be more error analyses in the NLG literature',
 'Q18_2': 'Please indicate whether you agree or disagree with the following
statements - Error analyses are a valuable part of a paper.',
 'Q18_3': 'Please indicate whether you agree or disagree with the following
statements - Carrying out an error analysis is enjoyable.',
 'Q18_4': 'Please indicate whether you agree or disagree with the following
statements - Carrying out an error analysis is boring/tedious.',
 'Q18_5': 'Please indicate whether you agree or disagree with the following
statements - Error analyses are necessary to fully evaluate the performance of
an NLG system.',
 'Q18_6': 'Please indicate whether you agree or disagree with the following
statements - Knowing what errors a system makes is helpful for future
research.',
 'Q18_7': 'Please indicate whether you agree or disagree with the following
statements - Knowing what errors a system makes is helpful for practitioners/NLG
in industry.',
 'Q18_8': 'Please indicate whether you agree or disagree with the following
statements - If you publish at a conference, and you present an NLG system as
one of your main contributions, you should include an error analysis.',
 'Q18_9': 'Please indicate whether you agree or disagree with the following
statements - If you publish in a journal, and you present an NLG system as one
of your main contributions, you should include an error analysis.',
 'Q19': 'I am … likely to include an error analysis in a journal article than/as
I would be for a conference publication.',
 'Q27': 'Please explain your answer to the previous question:',
 'Q20': 'Are there currently enough resources to support error analysis? -
Selected Choice',
 'Q20_2_TEXT': 'Are there currently enough resources to support error analysis?
- No, I am still missing: - Text',
 'Q21': 'Besides resources, are there any other factors that would make it more
likely for you to carry out an error analysis?',
 'Q23': 'What else would you recommend that authors should include in an error
analysis?',
 'Q24': 'This is the final question. Is there anything you would like to add or
comment on?'}
```

[7]:
```
"""
TODO:
- Subgroup analysis: academia vs industry
- Heatmap tables
"""
```

[7]:
```
'\nTODO:\n- Subgroup analysis: academia vs industry\n- Heatmap tables\n'
```

1 Demographics

[8]:
```
# Where do people come from?
basic_stats(consented, "Q2")
```

```
Academia: 41 (82.00%)
Industry: 8 (16.00%)
Other: 1 (2.00%)
```

[9]:
```
# Time spent working in NLG:
basic_stats(consented, "Q3")
```

```
6-10 years: 5 (10.20%)
Less than 2 years: 10 (20.41%)
2-5 years: 20 (40.82%)
11 or more years: 10 (20.41%)
I don't work in NLG: 4 (8.16%)
```

[10]:
```
# Read an error analysis:
basic_stats(consented, "Q4")
```

```
Yes: 26 (63.41%)
No: 15 (36.59%)
```

[11]:
```
# Is it surprising that you haven't read an error analysis?
basic_stats(consented, "Q8")
```

```
Yes, because:: 2 (33.33%)
No, because:: 4 (66.67%)
```

[12]:
```
# Why is it surprising?:
texts = get_texts(consented, 'Q8_1_TEXT')
write_texts(texts, "surprising_because.csv")

for text in texts:
    print(text)
    print('----')
```

```
using NLG systems every day, I know that however good the output is, it still
makes small mistakes that need correcting such as confusing "me" and "you"
roles.
----
Without an understanding of errors, especially regarding what the most frequent
errors involve, it is quite hard to correctly develop a system. It may end up
being just blind hyperparameter optimisation (for NN ones)
----
```

[13]:
```
# Why is it not surprising?:
texts = get_texts(consented, 'Q8_2_TEXT')
write_texts(texts, "not_surprising_because.csv")

for text in texts:
    print(text)
    print('----')
```

```
Page limit is often too less to report a detailed error analysis. Also manually
annotation of errors is very time consuming, even if the training data is
already manually annotated and the test data manually evaluated.
----
it is time-consuming and tedious. Furthermore, it seems there is disagreement
about standards, so that results cannot be compared sensibly.
----
```

[14]:
```
# Carried out an error analysis:
basic_stats(consented, 'Q9')
```

```
Yes: 21 (65.62%)
No: 11 (34.38%)
```

[15]:
```
# Willing to carry one out again (only people who answered 'yes'):
basic_stats(consented, 'Q28')
```

```
Probably yes: 7 (35.00%)
Definitely yes: 13 (65.00%)
```

[16]:
```
# Explanation for previous question
texts = get_texts(consented, 'Q29')
write_texts(texts, "carry_out_again_because.csv")

for text in texts:
    print(text)
    print('----')
```

```
Not on a formal and structured level as for now.
----
It can improve the results and quality of generations.
----
Need to measure accuracy of generated texts
----
They are too useful to not do them
----
Sometimes it is needed…
----
I think it's useful
----
```

```
It is useful
----
I think its important to manually inspect the data from a computational
linguistic perspective and it can provide valuable insights into improving
inputs perhaps or neural architectures in order to guarantee more semantically
adequate   production systems.
----
Essential part of evaluation!
----
I do believe in the importance of error analysis, so I'll make sure to include
them as much as possible. However, when working with collaborators, not everyone
sees its importance and is willing to invest time (and resources) on it.
----
Scores from automatic evaluation metrics cannot reliably detect or quantify all
types of errors in NLG, so manual error analysis is still probably the best kind
of evaluation.
----
Why not :)
----
I feel like the experience with the error analysis I have carried out helps me
to outline better categories in the future.
----
?
----
I think carring out error analyses is a way to improve the systems
----
Error analysis is crucial for many uses of NLG systems, especially for systems
intended to produce outputs for human audience.
----
```

[17]:
```
# Considered carrying one out (only people who answered 'no'):
basic_stats(consented, 'Q12')
```

```
Never: 4 (40.00%)
Once or twice: 2 (20.00%)
I'm planning to carry out an error analysis in the future: 3 (30.00%)
Regularly: 1 (10.00%)
```

[18]:
```
# Willing to carry one out (only people who answered 'no'):
basic_stats(consented, 'Q14')
```

```
Probably yes: 3 (27.27%)
Definitely yes: 3 (27.27%)
Might or might not: 4 (36.36%)
Probably not: 1 (9.09%)
```

[19]:
```
# Reasons for not doing it:
texts = get_texts(consented, 'Q13')
write_texts(texts, "reason_for_not_carrying_out.csv")

for text in texts:
    print(text)
    print('----')
```

```
Whilst I do correct errors, I've never really considered carrying out an error
analysis.
----
I didn't know of this option, I thought error description is enough.
----
I work in rule-based NLG, hence unexpected errors in output are unlikely
----
My work was on errors in people not text
----
My studies are taking much of my time
----
Hasnt been a part of my research problem, but is becoming increasingly relevant
----
The NLG systems I worked on were rule based, and before we evaluated them we
made sure that there were no errors.  We carried out task-based evaluations
comparing different strategies, and sometimes asked users to judge fluency etc
but there were no generation errors to analyse.
----
see above (tedious, lack of standards)
----
I used to work in NLG and don't any more (sorry there was no button for that at
the beginning). I worked on rule-based system and there was no error ananlysis
of the NLG because it didn't make any errors, we made sure the rules worked
correctly before the NLG was used as part of a bigger system.  There may have
been error analysis of e.g. the speech recognition errors which led to the wrong
response being generated, but not of the NLG itself.
----
```

2 Usefulness of error analyses

[20]:
```
# Found useful:
basic_stats(consented, 'Q5')
```

```
Moderately useful: 9 (36.00%)
Slightly useful: 2 (8.00%)
Very useful: 6 (24.00%)
Extremely useful: 8 (32.00%)
```

[21]:
```
# What was useful about the analyses?:
texts = get_texts(consented, 'Q6')
write_texts(texts, "uses_of_error_analysis.csv")

for text in get_texts(consented, 'Q6'):
    print(text)
    print('----')
```

```
General attention to the topic
----
general taxonomy gives idea of challenging aspects
----
Qualitative analysis plus examples more informative than numeric scores for
understanding where improvements are still needed
----
They help ground the limitations of the systems And create directions for future
work
----
Allows to assess whether things you belive could be improved are indeed the
things that should be
----
They help understand the limitation of the proposed method.
----
It gives a complementary picture of standard metrics.
----
Clear view on data and not only a cherry picking error description. The
different categories are helpful to identify problems of the NLG system. NLG is
often evaluated only by automatic metrics which are not perfect and do not take
all issues into account, such a error analysis can help to identify errors and
not only trying to reach the best scores. The NLG systems get more and more
black boxes which we don't know what they are doing so a manual analysis is
helpful for identifying problems which we had overlooked focusing on automatic
metrics.
----
Diversification of the errors, making the researcher able to fine-tune a system
based on them.
----
It provided useful insights into the type of errors produced in the output which
are not evident in string based or corpus based metrics - BLEU, BLEURT etc
----
It shows the kinds of failures the system has, and points to where problems in
the (often Black Box) System may lie.

It is also a good sign that the whole analysis of results has considered all
results.
----
Qualitative insights about what doesnt work.    Which is useful for planning
```

```
future research, and also for deciding whether to use a model/algorithm in a
project (since some types of errors are much more concerning than others)
----
They provide an idea of where the models are actually failing. This helps
understand if the proposed approach is tackling the problem it intends to solve
(or improve on). It also gives ideas for future work.
----
Error analyses can show the areas where a system struggles to generate the
correct output which can be accuracy, coherence, fluency, etc.
----
The way that error is treated in language due to the difficulty of  the natural
language processing methods and its variety across the different levels of
processes
----
Awareness of the kinds of biases these system exhibit when trying to generate
something meaningful and at the same point also showcasing what needs to be done
to further the improvement of these models
----
Providing extra depth about the state of their system. That is, providing more
detailed information about the strenghts and challenges regarding the system
that you would not be able to obtain if you would just report average fluency,
BLEU, etc. Furthermore, it is also more "objective" than the average qualitative
analysis that we often see, that generally just reports overall first
impressions of the author.
----
When NLG error analysis is conducted manually (i.e. by humans), it provides
valuable information about the quality of NLG, and also can tell us where the
problems are.
----
```

[22]:
```python
# For what kinds of papers are error analyses useful?:
texts = get_texts(consented, 'Q15')
write_texts(texts, "kinds_of_papers.csv")

for text in texts:
    print(text)
    print('----')
```

```
KPI standards
----
Dialogue systems, response generations
----
all NLG research.
----
most NLG papers
----
All papers with an experimental component
----
```

Ones proposing improvements, especially if the improvements have a certain goal (e.g. changing syntax, did only the bottom line change? or something syntactic) Probably can think of other things
---
Any paper really, but I understand that it is not always feasible, due to time and economic constraints. But it should be expected to a higher extent than currently.

I think an error analysis would be useful for any papers where an NLG system is generating text, and making mistakes. I hadn't heard of error analysis before this survey, but have read a lot of NLG papers, none of which contained an error analysis. Not doing so, seems at best a little dishonest.

All NLG paper with a small amount of test data so that the manual error annotation is easy doable. For example, paper proposing a new NLG system for machine translation, text simplification, text summarization, question answering…

E2E-NLG in particular, given the difficulties in debugging black-box models.

System papers - papers which claim to improve on semantic adequacy/controllability for neural text generation systems i.e. pipeline neural architecture and controllable neural generation, better input representation and evaluation papers in general.

Any work on a system that outputs text

Any paper which evaluates a model, algorithm, or system should include an error analysis
---
Pretty much all papers that claim to be doing something better than others. For NLG, in particular, just showing that a model gets higher X score(s) does not help understand why that is the case. It serves better to the community to have an understanding of the real capabilities and limitations of the models. So, to better compare systems, an error analysis can help show where a particular system is "doing better" than the other, making a stronger case for using it (or not).

- Papers describing novel approaches/architectures to NLG: It would be useful to know whether a particular approach is prone to making mistakes related to fluency, accuracy, coherency, etc.
- Papers comparing two or more NLG systems.

Journal of Automated Reasoning
Journal of Intelligent Systems
Journal of Logic and Computation

```
I think any NLG paper should conduct error analyses to help readers better
understand the limitations and potential risk of current model as well as
datasets.
----
Any paper which introduces a new NLG model should also talk about the pitfalls
of generations or the things that the model gets stuck in since that provides an
immediate reference to put things in perspective with.
----
Generally any paper that introduces a system in the NLG domain (even more
broadly: NLP). Especially if you have limited time and resources for a
quantitative human evaluation study, you can get interesting results with just a
small amount of annotators.
----
explainable AI and confidence analysis
----
For papers using neural generation models which can produce errors.
----
most of them: new models, new systems…
----
I have to say that what is considered an error depends partially on the intended
use of the NLG system. For systems that are intended to produce grammatical
coherent text for human audiences, error analysis is necessary in order to get a
good estimation of system quality. However, some systems might be intended to
produce different output, for example poetry, or literary-style imitations, so
criteria of errors may be different there. There might also be papers that focus
on computational efficiency, and thus disregard quality of output, so those
might avoid error analysis.

Some NLG papers use BLEU scores as indicators of NLG quality. This is very
convenient as BLEU scores can be computed automatically against available human-
sourced 'gold data'. But BLEU scores can be misleading and are not a good
alternative to manual analysis of errors.
----
```

[23]:
```
# Reasons for disappointment:
texts = get_texts(consented, 'Q7')
write_texts(texts, "reasons_for_disappointment.csv")

for text in texts:
    print(text)
    print('----')
```

3 Barriers and enabling factors

[24]:
```
# Challenges:
texts = get_texts(consented, 'Q10')
write_texts(texts, "challenges.csv")

for text in texts:
    print(text)
    print('----')
```

```
Scale and resources
----
It's time consuming and some times to cover all types of errors is very hard.
----
benchmarked against what? time-consuming. necessity for IRR (but usually lack of
willing qualified participants)
----
Time pressure
----
They can be time consuming to get right because it means contextualising your
numbers
----
Defining categories,
Choosing amount of effort to invest and in what
----
It's not cool, so some of the co-authors had a push back
----
It is hard to define clearly, especially in utput with poor quality, where the
source of errors can be multiple. There is a lack of clearly described schemes,
and the ones that exists are typically not well documented.
----
The lack of clear methodology - type of errors.   Some appear random they pick a
100 and categorise the errors with not error schema.  Often the sampling may or
may not be statistically significant and there is no attempt to justify the
sample size
----
Inter-annotator agreement.  Ie, trying to define the error analysis well enough
that different annotators produced comparable analyses.
----
Establishing a set of error categories that all annotators can understand and
apply. This requires several iterations (just like with any annotation
guideline). So, it is time consuming and tiring, specially if done only towards
the end of the project.
----
It was time-consuming and prone to mistakes, especially when analysing for
accuracy or correctness.
----
```

No previous experience in my area

There isn't really a standardized set of categories that you could use and build upon. So it felt like reinventing the wheel myself when trying to come up with a set of categories, going through the output.

If not performed by human, an error analysis can require to process the generated output, such processing tools must be independent from the generator and be robust enough. Such tools does not exist for all languages. If processed by human -> usual hassle of time, recruitment and biais
---
- deciding the sample size
- defining the error categories: not too broad, not too fine grained
---
Manual error analysis is very time-consuming. In my case, we also used 2 annotators, for measuring inter-annotator agreement. I had to prepare the rubrics, then prepare sample materials for training annotators, then conduct training trials. Only then we could begin the real annotation and analysis. So, again, it is a process that takes time and resources.
---

[25]:
```
# Enough resources/reference materials at the time?
basic_stats(consented,'Q11')
```

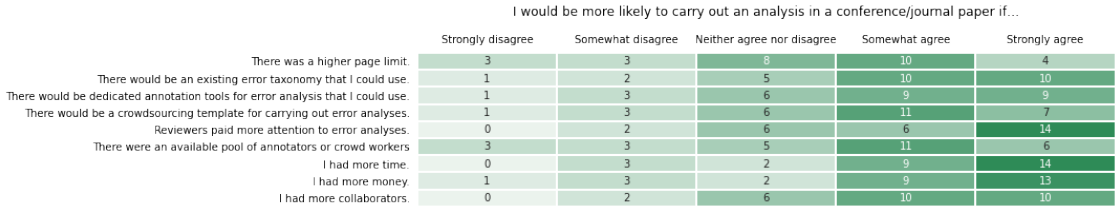
```
No: 12 (60.00%)
Yes: 8 (40.00%)
```

[26]:
```
answers = ['Strongly disagree', 'Somewhat disagree', 'Neither agree nor␣
 ↪disagree', 'Somewhat agree', 'Strongly agree']
records = []
for question, counts in underscored(16,9,consented).items():
    for answer in answers:
        percentage = 0
        if answer in counts:
            percentage = counts[answer]['number'] # NOTE: Changed into number␣
 ↪rather than percentage!
        record = dict(question=question, answer=answer, percentage=percentage)
        records.append(record)

df = pd.DataFrame(records)
# Pivot to make a square table:
df = df.pivot(index='question', columns='answer', values='percentage')
# Reorder columns:
df = df[['Strongly disagree', 'Somewhat disagree', 'Neither agree nor␣
 ↪disagree', 'Somewhat agree', 'Strongly agree']]

plt.rcParams["figure.figsize"] = (15,3)
```

```
ax = sns.heatmap(df,cmap=sns.light_palette("seagreen",␣
 ↪as_cmap=True),linewidth=1,cbar=False,annot=True)
ax.xaxis.tick_top()
plt.xticks(np.arange(5) + 0.5, labels=answers)
plt.yticks(np.arange(9) + 0.5, labels=get_questions(16,9))
plt.tick_params(top=False,left=False)
plt.xlabel('')
plt.ylabel('')
plt.title("I would be more likely to carry out an analysis in a conference/
 ↪journal paper if…", y=1.2)
plt.tight_layout()
plt.savefig("Q16.pdf")
```



[27]:
```
# Other barriers?
texts = get_texts(consented, 'Q17')
write_texts(texts, "other_barriers.csv")

for text in texts:
    print(text)
    print('----')
```

```
No
----
no
----
Trade-off between improving model/approach vs conducting error analysis
----
Time is the largest barrier
----
Yes. It is not popular to conduct error analysis these days, unfortunately.
----
Not really.  I've just never considered running one.
----
My supervisor do not see the relevance of it as we know no paper with such a
error analysis and hence they recommend me to not spend much time on it.
----
No
----
```

```
Reproducibility of error analysis or human evaluation in general would be
another concern, but there has been some interesting work recently in this area.
----
The importance given to error analyses is very low in the current research
paradigm and we optimize for scores from reviewers for novelty not for wrror
analysis
----
Mostly time and resources, if there is a strict deadline, it is oftentimes
quicker to just do a very straightforward quantitative analysis.
----
lack of tools and resources for all languages
----
I think error analysis should be carried out if possible by experts on the area
and not by crowdworkers.
----
Time, money, availability of adequate annotators. A taxonomy of errors could be
useful, but it cannot cover everything - there is a variety of issues that can
be considered errors, including things that are errors only in some situation
but not in other.. Also, a too-big of a taxonomy could be inconvenient to use.
----
```

[28]:
```
# Enough resources/reference materials currently?
basic_stats(consented,'Q20')
```

```
No, I am still missing:: 18 (69.23%)
Yes: 8 (30.77%)
```

[29]:
```
# What is still missing?
texts = get_texts(consented, 'Q20_2_TEXT')
write_texts(texts, "missing.csv")

for text in texts:
    print(text)
    print('----')
```

```
Standards
----
the ability to outsource error analysis!
----
Better documented taxonomies and procedures
----
Funding.  Whilst an error analysis is important, the way I work would mean that
performing an error analysis would take away time from working on the NLG system
itself, which could in turn reduce errors made.  Funding could help this.
----
Knowledge on the topic. I don't which resources exist yet.
----
Don't know which tool is missing, but the practice itself seems relatively
```

```
novel, so I can expect new resources coming in the future.
----
Error analysis taxonomy, best practices, guidance, annotation tools.
----
An efficient guideline and platform for setting the standard and replicable
error analysis.
----
taxonomies, examples how to use them, tools
----
A good taxonomy of error categories you could typically use.
----
I am not aware of widely recognized resources for error analysis  in NLG.
----
```

[30]:
```
# Other factors that make it more likely for you to carry out an error analysis?
texts = get_texts(consented, 'Q21')
write_texts(texts, "enabling.csv")

for text in get_texts(consented, 'Q21'):
    print(text)
    print('----')
```

```
Automation
----
No
----
perhaps, but I cannot think of one at the moment
----
More explicit recognition of value of error analysis in review forms
----
Having it as a requirement. Or ideally making it more common, as a practice that
is considered valuable, and then researchers would be inclined to do it not bc
of a requirement.
----
More money for research, and easier to higher short-term staff.
----
No, on balance I think it's something that should be done when presenting a
paper or a conference talk.
----
More acceptance of error analysis in the NLP community.
----
Time and resources (to support the activity )
----
This is mostly a problem with research culture, when this (error analyses)
becomes normal resources will be produced to fulfil the need for resources.
----
More money
----
```

A thorough task specific taxonomy which easily helps immediately attribute errors found in a certain bucket and also helpful since anything not belonging to the buckets is important and worthy to look at

---

money dedicated for persons doing the analyses, and also money for instructing them clearly in order to get comparable results

---

Having more experience with carrying it out would limit the amount of time necessary to set one up.

The major factor is that researchers must be acutely aware of the importance of error analysis for research, and for industrial/market applications..

---

4 General opinions

[31]:
```
answers = ['Strongly disagree', 'Somewhat disagree', 'Neither agree nor␣
 ↪disagree', 'Somewhat agree', 'Strongly agree']
records = []
for question, counts in underscored(18,9,consented).items():
    for answer in answers:
        percentage = 0
        if answer in counts:
            percentage = counts[answer]['number']
        record = dict(question=question, answer=answer, percentage=percentage)
        records.append(record)

df = pd.DataFrame(records)
# Pivot to make a square table:
df = df.pivot(index='question', columns='answer', values='percentage')
# Reorder columns:
df = df[['Strongly disagree', 'Somewhat disagree', 'Neither agree nor␣
 ↪disagree', 'Somewhat agree', 'Strongly agree']]

plt.rcParams["figure.figsize"] = (15,4)
ax = sns.heatmap(df,cmap=sns.light_palette("seagreen",␣
 ↪as_cmap=True),linewidth=1,cbar=False,annot=True)
ax.xaxis.tick_top()
plt.xticks(np.arange(5) + 0.5, labels=answers)
plt.yticks(np.arange(9) + 0.5, labels=get_questions(18,9))
plt.tick_params(top=False,left=False)
plt.xlabel('')
plt.ylabel('')
plt.title("...", y=1.2)
plt.tight_layout()
plt.savefig("Q18.pdf")
```

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
There should be more error analyses in the NLG literature	0	1	1	10	15
Error analyses are a valuable part of a paper.	0	0	2	4	21
Carrying out an error analysis is enjoyable.	0	5	6	13	2
Carrying out an error analysis is boring/tedious.	3	3	5	15	0
Error analyses are necessary to fully evaluate the performance of an NLG system.	1	0	1	5	19
Knowing what errors a system makes is helpful for future research.	0	0	0	9	17
Knowing what errors a system makes is helpful for practitioners/NLG in industry.	0	0	1	5	20
If you publish at a conference, and you present an NLG system as one of your main contributions, you should include an error analysis.	0	0	5	12	9
If you publish in a journal, and you present an NLG system as one of your main contributions, you should include an error analysis.	0	0	2	9	15

[32]:
```
# More/less/equally likely to include error analysis in journal
basic_stats(consented, 'Q19')
```

```
Equally: 12 (46.15%)
More: 14 (53.85%)
```

[33]:
```
# Explanation for previous question:
texts = get_texts(consented, 'Q27')
write_texts(texts, "explanation_journal_preference.csv")

for text in texts:
    print(text)
    print('----')
```

```
It's make my NLG system more accurate.
----
Based on assumption that the conference is NOT ACL or similiar top-tier venue!
----
More space, less deadline pressure
----
The difference would be the depth of the analysis but heading something remains
Important in both cases
----
The quality of my work should not differ by the venue
----
I think it should be a norm, similar to reporducibility, at both venues.
----
There are more space and higher expectations.
----
Having discovered that error analysis is a thing, if I were in the position of
writing a paper or presenting at a conference, I would almost certainly include
an error analysis.
----
Higher page limit, more time to publish, more quality and higher demands in
journal articles
----
```

Journal article usually offer a higher page limit.

I think for long papers it is essential and I would expect this any ACL endorsed conference.
Also I think there is an overeliance on metric based evaluations without any clear understanding of there strengths and weakness(BLEU) and a general decline to provide any linguistic analysis of outputs. I fear the focus on deep learning approaches has resulted in a decline of computational linguistic skills in postgraduate researchers (with solely an ML training) and nor are such research evaluation encouraged. In some cases they don't have the linguistic skills.

More space and time involved in a journal publication, means it is more likely to have an error analysis.

Error analyses should be included in both conf and journal papers
---
Normally, having more space in a journal article allows to expand on the experiments, including the error analysis. However, since our research are is heavily conference-focused, our main points of reference are conference papers. So, since they are regarded in a higher standard, they should also be subjected to a higher level of scrutiny and quality expectation. So, I do think an error analysis should be included in both.

The deadlines and page limits for conference papers are typically tighter, so I would be slightly less likely to do this a conference paper.

Error analysis will contribute to may article definitely because it can increase the what my investigation has done.

Journal articles are more comprehensive, and they should include an error analysis to give a more complete picture of an NLG system.

Bigger page limit, you are not as much faced with a strict deadline that requires you to think about how to do the most in the least amount of time.
---
depend on size and the study. If the system is for legal/medical purpose or for creativity
---
journal reviewers tend to be more demanding on details, including error analysis. Also, journals provide more space (pages) for articles.
---

5 Requirements for reports of error analyses

[34]:
```
texts = get_texts(consented, 'Q23')
write_texts(texts, "reporting_requirements.csv")

for text in texts:
    print(text)
    print('----')
```

```
 May be a table that show correlation between different types of errors.
----
sufficient evidence to evaluate the standard of the human rater(s)
----
Better to use a sensible characterization of errors that actually occur rather
than trying to shoehorn them into an existing taxonomy
----
This is important. Thanks!
----
I think including the types of errors made is fine, however, I think that a list
of the errors would be incredibly useful, as this would allow people reading
papers to see commonality amongst NLG systems (for example, do GPT-J, GPT-3 and
GPT-NeoX all make the same mistakes?)
----
Annotation schema in which they explain their error categories if adapted from
another NLG task, e.g., question answering might require other categories than
machine translation.
Not only raw numbers, maybe percentages would be better. Also naming which
categories were ignored and due to which reasons.
----
statistically driven sampling (stratified where appropriate even)
----
If (real) users find the system helps in a (real) task.
----
Annnotation process should be described in enough detail that other researchers
can replicate the analysis and get similar results
----
The annotation guidelines, and the process followed to train the annotators.
This can help with adopting a similar methodology for papers on the same task
that aim to compare against them.
----
Types of errors and how that impacts a system. E.g., a system which generates
fluent and grammatically correct output but contains factual error is not very
useful.
----
A description of how the authors created the categories, with some opportunity
for the annotators to report their satisfaction with the aplicability of the
categories.
```

```
----
Proper metrics for measuring inter-annotator agreement. This is an issue not
only in NLG. There is a variety of metrics and they are not all well-known or
properly used.

However, I also warn aginst over-formalising error analysis!
----
```

6 General comments

[35]:
```
texts = get_texts(consented, 'Q24')
write_texts(texts, "general_comments.csv")

for text in texts:
    print(text)
    print('----')
```

```
Thanks
----
No
----
no
----
Talk to PCs about review forms
----
No.  Thank you for introducing me to the concept of error analysis.  In at least
some small way, I will probably take this concept and use it in our work.
----
I didn't know much on error analysis before answering the questionnaire, hence,
I couldn't rate the amountzof existing error analysis tools. I would have liked
to have a "I don't know" field for the Likert scale questions.
----
This is an important study
----
Thanks for carrying out this survey. Looking forward to the results and the
recommendations.
----
thanks for doing such study
----
Error analysis should focus on language features, text genre characteristics and
adequacy to the task, not a mere statistical analysis.
----
Thank you, it was a quite good survey.
----
```

[ ]: