

A decorative graphic on the left side of the slide consists of two overlapping parallelograms. The front one is blue and the back one is a light green. They are positioned diagonally, with the blue one partially covering the green one.

Yield Strength

Week 9

Progress

```
err = []
for m in check_list:
    if m.strip() in gtd_list:
        val = gen_value[check_list.index(m)]
        cor = gtd_value[gtd_list.index(m.strip())]
        err.append(abs(val - cor) / cor)
    else:
        material = m.strip()
        found = False
        for gtd in gtd_list:
            if material in gtd:
                prev_idx = gtd.index(material) - 1
                next_idx = gtd.index(material) + len(material)
                if prev_idx > 0 and (gtd[prev_idx].isalpha() or gtd[prev_idx].isdigit()):
                    continue
                if next_idx < len(gtd) and (gtd[next_idx].isalpha() or gtd[next_idx].isdigit()):
                    continue
                val = gen_value[check_list.index(m)]
                cor = gtd_value[gtd_list.index(gtd)]
                err.append(abs(val - cor) / cor)
                found = True
                break
        if not found:
            err.append(-1)

print("Total:", len(check_list))
print("Found:", len(err) - err.count(-1))
print("Unkdown:", err.count(-1))
for i in range(len(err)):
    if err[i] == -1:
        err[i] = None
result_df = pd.DataFrame({
    "Material": check_list,
    "percentage of error": err
})
```

Total: 44
Found: 23
Unkdown: 21

	Material	percentage of error
0	CoCrFeMnNi	0.212963
1	AlCrCuFeNi	NaN
2	FeCoNiCrMn	1.096774
3	AlCoCrFeNi	0.544000
4	CoCrFeMnNiTi	NaN
5	CoCrFeMnNiV	0.578313
6	CoCrFeMnNiMo	NaN
7	AlCuCrFeNi	NaN
8	CoCuFeMnNi	0.322222
9	CoCrFeNi	0.483333
10	CoCrFeMnNi	0.212963
11	AlCrCuFeNi	NaN
12	FeCoNiCrMn	1.096774
13	AlCoCrFeNi	0.544000
14	CoCrFeMnNiTi	NaN
15	CoCrFeMnNiV	0.578313
16	CoCrFeMnNiMo	NaN
17	AlCuCrFeNi	NaN
18	CoCuFeMnNi	0.322222

- From last week: improve and modify the code to check match and return accuracy
- This time, we have found much more entries matches than last week
- However, the accuracy rate is terrible. Among those found matches, the average error rate is 0.5620184819104491.

Progress - Dive into why the values generated are far away from the true value

- It seems like Chat GPT are just generating yield strength value hypothetically

Here is a hypothetical example table:

Material	Yield Strength (MPa)
FeCoNiCrMn	300
AlCoCrFeNi	650
CoCrFeMnNi	520
AlTiVCr	400
NiFeCrCoMnCu	750
CoCrFeNiPd	580
MnFeCoCrNi	450
CrMnFeCoNi	620
AlLiMgScTi	710
VNbMoTaW	800





Progress

- Words from Chat GPT



ChatGPT

As an AI language model, I don't have access to information about specific websites used in my training data. My responses are generated based on a mixture of licensed data, data created by human trainers, and publicly available data from various sources. These sources could include websites covering a wide range of topics, but I don't have the ability to identify or list them. My training involved processing and learning from diverse text sources to develop a broad understanding of human language.

- New Idea: Add a third column: Ask GPT where is the value comes from

Progress

- As we can see, if we ask GPT to provide where is the value comes from, it generates **much less** entries than when doesn't ask for the reference
- This implies that GPT doesn't really have a good database on yield strength.
- Moreover, when we dive into the reference, we found that ChatGPT does a poor job on extracting property values. Those paper doesn't have the yield strength about the materials, so it might just generate the value based on the learning the formulas in the paper

Material	Yield Strength (MPa)	Source
CoCrFeMnNi	500-800	[1]
AlTiVCrFeNi	900-1500	[2]
CrMnFeCoNi	450-650	[3]
CoCrFeNi	400-800	[4]
AlCoCrFeNi	300-600	[5]

Sources:

1. Yeh, Jien-Wei, et al. "Nanostructured high-entropy alloys with multiple principal elements: Novel alloy design concepts and outcomes." *Advanced Engineering Materials* 6.5 (2004): 299-303.
2. Senkov, O. N., et al. "Microstructure and room temperature properties of a high-entropy TaNbHfZrTi alloy." *Journal of Alloys and Compounds* 509.20 (2011): 6043-6048.
3. Cantor, B., et al. "Microstructural development in equiatomic multicomponent alloys." *Materials Science and Engineering: A* 375 (2004): 213-218.
4. Lu, Z. P., et al. "High-entropy alloys with high saturation magnetization, electrical resistivity, and malleability." *Science* 345.6203 (2014): 1593-1596.
5. Zhang, Y., et al. "Microstructures and properties of high-entropy alloys." *Progress in Materials Science* 61 (2014): 1-93.



Future Steps / Questions

- The analysis of GPT yield strength learning ability demonstrate that it doesn't have a solid database of yield strength.
- Machine Learning added on?
 - Next week, our thought is to give 1/10 of our group truth table to GPT as the train data for yield strength as well as some background information about yield strength that helps Chat GPT get access
- Improvement?
 - tell GPT to return materials' yield strengths only for those which appear in the paper or in its database



Summary

Date	Hours	Description of Work
04/08	4	Improvement of code from previous week
04/09	3.5	Found credibility problems of GPT and figure out potential ways to solve it
Throughout week	2	Compile all work into group slides