Clarity Care AI - MLE Assignment

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1. Data Collection

Automatically scrape the information from the websites.

Use selenium to simulate a human.

Oscar

- (notebook) Extraction of the pdf but bad formatting (no space)

For the future: download the pdf and input it inside an OCR model like LayoutLLM

```
ClinicalGuideline
OscarClinicalGuideline:Acupuncture(CG013,Ver.10)
Acupuncture
Disclaimer
Clinicalguidelinesaredevelopedandadoptedtoestablishevidence-basedclinicalcriteriafor
utilizationmanagementdecisions.Clinicalguidelinesareapplicableaccordingtopolicyandplantype.
ThePlanmaydelegateutilizationmanagementdecisionsofcertainservicestothirdpartieswhomay
developandadopttheirownclinicalcriteria.
Coverageofservicesissubjecttotheterms,conditions,andlimitationsofamember'spolicy,aswell
asapplicablestateandfederallaw.Clinicalguidelinesarealsosubjecttoin-forcecriteriasuchasthe
CentersforMedicare&MedicaidServices(CMS)nationalcoveragedetermination(NCD)orlocal
coveragedetermination(LCD)forMedicareAdvantageplans.Pleasereferttothemember'spolicy
documents(e.g.,Certificate/EvidenceofCoverage,ScheduleofBenefits,PlanFormulary)orcontact
thePlantoconfirmcoverage.
Summary
Acupuncturehasbeenwidelypracticedformanyyearsinvariouspartsoftheworld.Itinvolvesthe
stimulationofspecificbodyareasbypenetratingtheskinwithfineneedles.Stimulationcanbe
accomplishedelectricallyormanually.
Acupuncturehasbeensuggestedasaviabletreatmentoptionforawidevarietyofacuteandchronic
painconditionsinbothchildrenandadults.However,determiningtheclinicalutilityofacupuncturehas
beenchallenging,largelyrelatedtothedifficultiesindesigningstudieswithadequateblinding,controls,
sizeanduniformoutcomemeasures.Furthermore,acupunctureisapassivemodalityandassuchshould
beusedinconjunctionwithactiverehabprogramswhenapplicable.
ThePlanmembersmaybeeligibleforacupuncturedependingontheirplan.Acupunctureisa
consideredmedicallynecessaryserviceonlywhenusedasasubstitutefortraditionalanesthesiaandfor
```

Aetna

- (notebook) Scraper detected by the website

For the future: more work to solve the detection of the scraper…

Oops! We need to validate a few things before you can log in.

We noticed something about your browser (Chrome, Edge, Safari, etc.) that makes us think you are a bot. Here are a few reasons this may happen:

- You're using a browser plugin that's stopping JavaScript from running
- You're using a VPN or privacy software often used by attackers
- You're moving through the site at super-human speed

What should I do?

- Just click the I'm not a robot checkbox
- Solve/complete the CAPTCHA, if presented
- The site will remember you the next time you visit (assuming your IP address doesn't change)
- Log in as usual

1	Click "I'm not a robot" below
2	Solve additional CAPTCHA
3	Continue browsing

www.aetna.com Additional security check is required

☐ Je ne suis pas un robot

reCAPTCHA
Confidentialité - Conditions

Anthem

- Scraper_anthem.py file
- Able to extract raw policies for every category using selenium
- Parsing of the html using *Beautifulsoup* library

```
{
  "url": "https://www.anthem.com/dam/medpolicies/abc/active/policies/mp_pw_e003052.html",
  "subject": "Gene Therapy for Metachromatic Leukodystrophy",
  "document_number": "MED.00148",
  "publish_date": "05/16/2024",
  "status": "New",
  "last_review_date": "05/09/2024",
  "html_content": "<p><strong>Medically Necessary:</strong></p>\n<p>A one-time infusion of atidar
  "content": "Medically Necessary:\nA one-time infusion of atidarsagene autotemcel is considered
```

2. Data Standardization

- Use of LLM to format the raw medical policy
  - Extraction of informations about the policy
  - Format the textual medical necessity criteria into a decision tree with logic operators

- Prompt available in the `instructions.py` file

2 methods:
  - OpenAI API (`gpt-4o`) ➝ create the groundtruth
  - Smaller models (Mistral-7b/Llama-7b)
    - Not enough RAM on my computer and no GPU to load the quantizized versions
    - Tried Mistral-7b-Instruct on *Jan* (local quantizized .cpp version) that seems to work well

Final output

```json
[
  {
    "url": "https://www.anthem.com/dam/medpolicies/abc/active/policies/mp_pw_a053265.html",
    "subject": "Use of 3-D, 4-D or 5-D Ultrasound in Maternity Care",
    "document_number": "RAD.00038",
    "publish_date": "04/10/2024",
    "status": "Reviewed",
    "last_review_date": "02/15/2024",
    "html_content": "<p><strong>Investigational and Not Medically Necessary:</strong></p>\n<p>The use of 3-D, 4-D or 5-D fetal ultrasound is consid
    "content": "Investigational and Not Medically Necessary:\nThe use of 3-D, 4-D or 5-D fetal ultrasound is considered investigational and not med
    "criteria": [
      {
        "model": "gpt-4o",
        "criteria": [
          {
            "medical_act": "3-D, 4-D or 5-D fetal ultrasound",
            "sub_medical_act": null,
            "necessity_type": "Investigational and Not Medically Necessary",
            "description": "The use of 3-D, 4-D or 5-D fetal ultrasound is considered investigational and not medically necessary in all cases.",
            "conditions": null
          }
        ],
        "usage": {
          "total_tokens": 937,
          "prompt_tokens": 849,
          "completion_tokens": 88,
          "total_cost": 0.005565,
          "processing_time": 2.2381818294525146
        }
      }
    ]
  },
```

Local Mistral-7b-Instruct run on *Jan*

INPUT:

--Renal Sympathetic Nerve Ablation--

Investigational and Not Medically Necessary:

Ablation of the renal sympathetic nerves is considered investigational and not medically necessary for all indications.

👋 **Jan** 03/06/2024, 16:19:46

```
[
{
"medical_act": "Renal Sympathetic Nerve Ablation",
"sub_medical_act": null,
"necessity_type": "Investigational and Not Medically Necessary",
"description": "Ablation of the renal sympathetic nerves is considered investigational and not medically necessary for all indications.",
"conditions": null
}
]
```

3. Algorithm Evaluation

OpenAI

- Accuracy and completeness: no groundtruth for automatic evaluation but, at first glance, it seems to give very good performances (near perfect)

- Consistency across data source: no problem

- Time and cost available in the .json file

- Scalable method: automatic process

→ could be the groundtruth for automatic evaluation of other LLMs

Comments:

- It is a costly extraction method but the extraction is a one-time process (once it is done, a priori no need to do it regularly)

Conclusions

1. Effectiveness: How well does the algorithm extract and standardize the medical necessity criteria?

→ pretty efficient

2. Innovativeness: How innovative are the solutions to challenges faced during the project?

→ use of scraper and LLM models, eventually LayoutLLM (OCR) for pdfs

3. Scalability: Can the solution be scaled to accommodate larger datasets or multiple insurance policies?

→ Once personalized for the website, selenium as a scraper is scalable

→ LLMs for data standardization is also scalable (only cost for OpenAI service is annoying but running OpenSource LLM models on EC2 might decrease the costs - to be evaluate)