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Problem: Choosing agricultural insurance plans is a difficult task to do correctly.

Our Solution: Create a conversational assistant which will aid people in understanding and choosing insurance policy terms [1].
(This bar code has been deprecated past summer 2024, other bar codes on pages have been removed)
Frontend

Open Source
Shadcn Component Library
NextJS

Google OAuth
Agricultural Insurance LLM Project

This is an interactive conversational assistant to improve agricultural insurance selection, with large language models (LLMs).

You can start a conversation here or try the following examples:

- See if you are eligible for insurance
- Find requirements for your person type
- Look up definitions for terms

mistral/latest
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LLMs can make mistakes. Verify important information. Data is pulled from insurance handbook.
What does final area revenue mean?

LLMs can make mistakes. Verify important information. Data is pulled from Insurance Handbook.
How can I enroll in the PRF insurance program for my land?

To enroll in the Pasture, Rangeland, Forage (PRF) insurance program for your land, you need to contact an Approved Insurance Provider (AIP) that offers PRF coverage in your area. The AIP must offer the PRF program to all producers where it is available. You will need to provide specific information about your acreage and intended use for grazing to determine your coverage options and premium rates. The AIP will guide you through the enrollment process and provide you with the necessary policy documents.

Citations:

- Reference: paragraph from page 1 of section 1 in subsection B

- Document: Source of Authority The RI plans of insurance are authorized under Section 522(c) of the Federal Crop Insurance Act. Initially the only crop covered was PRF. However, other products that utilize the provisions of the RI plans of insurance were approved by the FCIC Board of Directors under Section 508(h) of the Federal Crop Insurance Act. The PRF program is an RMA developed product approved by the FCIC Board of Directors under Section 522(c) of the Federal Crop Insurance Act. The apiculture and the AF programs are privately developed products approved by the FCIC Board of Directors under Section 508(h) of the Federal Crop Insurance Act.

- Reference: paragraph from page 42 of section 55 in subsection A
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Reference: paragraph from page 3 of section 4 in subsection A

Document: AIP's Responsibilities (1) must provide persons insured under the Rainfall Index plans of insurance a copy of the Rainfall Index Plan Common Policy and the applicable crop policy; (2) must report any program issues or concerns related to the Rainfall Index plans of insurance or associated crop policies to RMA Director of PASD; (3) electing to offer the apiculture or AF programs must offer the program(s) to all eligible producers in the area where the program is offered; (4) must offer the PRF program to all producers where the program is offered; and (5) must report the latitude and longitude of the point of reference on the acreage report. This can be obtained from the grid locator map from the RMA website or an AIP’s mapping software.

Reference: paragraph from page 42 of section E5 in subsection A

Document: Rainfall Index - Pasture, Rangeland, Forage Example: A. Overview
This exhibit provides an example of a producer who has elected to insure PRF acreage under the Rainfall Index plan of insurance. It also provides an illustration of how indemnities would be calculated. The same basic information is applicable to the apiculture program. However, there are some differences between the Rainfall Index and the apiculture, AF, and PRF programs. Some of the differences include, but are not limited to, the number of index intervals required to be insured, limitations on the maximum percent of value that may be selected in an index interval, growing seasons, the applicability of different intended uses, and the payment calculation factor. See the Rainfall Index Plan Common Policy, AF CP, Apiculture CP and AD for more information about each plan and crop policy. The following information is applicable to this example. (1) The county base value per acre for an intended use of grazing is $20.00. (2) The expected grid index is 100 for each grid ID, intended use, and index interval. (3) The premium rate for 90 percent coverage level for an intended use of grazing is: (a) 0.1000 in the April – May index interval; and (b) 0.1100 in the July – August index interval. (4) The premium subsidy factor for 90 percent coverage level is 51 percent. (5) Some of the calculations in the example are rounded to the nearest whole dollar.
Reference: paragraph from page 3 of section 4 in subsection A

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Exhibit 5  
Rainfall Index - Pasture, Rangeland, Forage Example

A. Overview

This exhibit provides an example of a producer who has elected to insure PRF acreage under the Rainfall Index plan of insurance. It also provides an illustration of how indemnities would be calculated.

The same basic information is applicable to the apiculture program. However, there are some differences between the Rainfall Index and the apiculture, AF, and PRF programs. Some of the differences include, but are not limited to, the number of index intervals required to be insured, limitations on the maximum percent of value that may be selected in an index interval, growing seasons, the applicability of different intended uses, and the payment calculation factor.

See the Rainfall Index Plan Common Policy, AF CP, Apiculture CP and AD for more information about each plan and crop policy.

The following information is applicable to this example.

(1) The county base value per acre for an intended use of grazing is $20.00.

(2) The expected grid index is 100 for each grid ID, intended use, and index interval.

(3) The premium rate for 90 percent coverage level for an intended use of grazing is:
   (a) 0.1000 in the April – May index interval; and
   (b) 0.1100 in the July – August index interval.

(4) The premium subsidy factor for 90 percent coverage level is 51 percent.

(5) Some of the calculations in the example are rounded to the nearest whole dollar.

B. Producer A’s Acreage Information
What does final area revenue mean?

Thank you for providing the context information. Based on the provided passage, "final area revenue" refers to the total revenue generated by a specific area of land over a particular period, usually at the end of the crop season or growing year. The passage highlights the importance of establishing a point of reference for each intended use, irrigation practice, and organic practice within a grid, which is selected by the Insured. This is necessary to determine the final area revenue for each acreage within the grid.

In the passage, there are four points of reference listed:

1. One point of reference within the field boundaries within grid ID 22939 for the acreage intended for having assigned to that grid ID.
2. One point of reference within the field boundaries within grid ID 22940 for the acreage intended for grazing assigned to that grid ID.
3. An agreement/arrangement that allows placement of colonies in the insured grid ID and county.
4. A lease certification form that is verifiable and true.

The passage also notes that if there is no agreement or arrangement in place, the insured will be subject to section 16(d) of the Basic Provisions, which means they will not be eligible for indemnities and will still owe premium.
Backend

- Flask
- Ollama
- Redis
- Docker
- Kubernetes
Key Implementation Details

- Utilizing Retrieval-Augmented Generation (RAG)
  - Question → relevant info (VectorDB) → craft response (LLM)

- Ollama to orchestrate LLMs
  - One package, run/manage several LLMs

- Multi-pod configuration on Kubernetes
  - Frontend, API, Redis, Ollama (LLMs)
Hand Segmentation

[Code Snippet]

```json
[
  {
    "id": 1,
    "document": "Purpose and Objective This handbook provides procedures and information for administering the Rainfall Index plans of insurance. If there is a conflict between this handbook and the CIH or other FCIC approved handbook, this handbook controls. If there is a conflict between this handbook and the policy, the policy controls."
  },
  {
    "metadata": {
      "page": "1",
      "section": "1",
      "subsection": "A",
      "type": "paragraph"
    }
  },
  ...
]```


Testing
Our Approach

"models": [
  "llama2:latest",
  "llama2:13b",
  "mistral:latest",
  "neural-chat:latest",
  "qwen:14b",
  "gpt-4"
],

"questions": [
  "How can I enroll in the PRF insurance program for my land?",
  "What are the premium costs associated with PRF insurance?",
  "How does the PRF insurance determine which weather stations data is used for my land’s location?",
  "What is the deadline for purchasing PRF insurance for the upcoming season?",
  "How are rainfall levels measured and recorded for PRF insurance purposes?",
  "In case of a drought, how quickly can I expect an indemnity payment from my PRF insurance?",
  "Can I combine PRF insurance with other types of crop insurance I already have?",
  "Are there specific record-keeping requirements I need to follow to maintain my eligibility for PRF insurance?",
  "What is the purpose and objective of the Rainfall Index insurance plans?",
  "Under what authority are the RI insurance plans, including the PRF program, authorized?",
  "How does the PRF program ensure compliance with Title VI of the Civil Rights Act of 1964?",
  "What are the responsibilities of AIPs in offering the PRF program?",
  "Can you explain the process for selecting a grid ID for PRF insurance coverage?",
  "How is the Productivity Factor used in determining coverage under the RI plans?",
  "What are the requirements for acreage reporting under the PRF program?",
  "How does the Rainfall Index design calculate indemnity payments?",
  "What constitutes a cause of loss under the Rainfall Index plans of insurance?",
  "How are indemnity payments determined for the RI plans?",
  "What steps should be taken to establish a point of reference for acreage under the RI plans?",
  "Explain the difference between contiguous and noncontiguous acreage in the program?"
]
Results

Score for each Question in Test Bench

- Hand Segmented
- Embeddings
Documentation

Can be found in our VTechworks submission
Challenges
Main Challenges

- Assessing response quality of LLMs
- Effective testing mechanism
Future Work
Visualizations

- Serving Images
- Generating Images
- This Particular Image is From FDD (Foundation for Defense of Democracies)
Acknowledgements

We would like to acknowledge Dr. Edward Fox, Dr. Elinor Benami, Dr. Manoochehr Shirzaei, Ramaraja Ramanujan, and Mehmet Yardimci for the help they have given us with this project.
Thanks!

Do you have any questions?

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