# 🛡️ AI Fraud Detection Dashboard

A comprehensive fraud detection system with real-time monitoring, machine learning models, multi-agent intelligence network, and advanced AI capabilities powered by OpenAI.

## 🌟 Features

### **Core Fraud Detection**

* **Real-time Fraud Detection**: Monitor transactions in real-time with ML-powered risk scoring
* **Multi-Model Ensemble**: Logistic Regression, Random Forest, and Isolation Forest
* **Analytics Dashboard**: Comprehensive charts and performance metrics
* **Analyst Review System**: Manual review and feedback collection
* **Model Management**: Real-time model performance monitoring

### **AI-Powered Capabilities**

* **OpenAI Playground Integration**: 5 AI-powered features with latest GPT models
* **Multi-LLM Chatbot**: Support for Ollama, OpenAI, HuggingFace, and rule-based responses
* **Code Generation**: Generate fraud detection code with AI
* **Data Analysis**: AI-powered transaction pattern analysis
* **Report Generation**: Automated fraud analysis reports
* **Model Explanation**: Explain why transactions are flagged

### **Advanced Features**

* **Fraud Intelligence Network**: Connect with other agents and systems
* **Multi-Agent Communication**: Real-time intelligence sharing
* **Indonesian Banking Integration**: BI-FAST and local bank consortium support
* **Global Fraud Networks**: SWIFT, Visa, Mastercard integration ready

## 🚀 Quick Start

### Local Development

1. **Clone the repository**

* git clone https://github.com/ghifiardi/fraud\_modelling\_dashboard.git  
  cd fraud\_modelling\_dashboard

1. **Install dependencies**

* pip install -r requirements.txt

1. **Run the dashboard**

* python3 -m streamlit run src/dashboard.py --server.port 8501

1. **Open your browser** Navigate to http://localhost:8501

### 🎯 Streamlit Cloud Deployment

This dashboard is ready for deployment on Streamlit Cloud!

1. **Fork this repository** to your GitHub account
2. **Go to** [**Streamlit Cloud**](https://share.streamlit.io/)
3. **Connect your GitHub account**
4. **Deploy the app**:
   * Repository: your-username/fraud\_modelling\_dashboard
   * Main file path: streamlit\_app.py
   * Python version: 3.9+

## 📊 Dashboard Sections

### 1. Real-time Dashboard

* Live transaction monitoring
* Key performance metrics
* Real-time charts and visualizations
* Risk distribution analysis

### 2. Transaction Monitor

* Individual transaction analysis
* Risk scoring and recommendations
* Recent transaction history
* Custom transaction testing

### 3. Analytics

* Model performance metrics
* Transaction patterns
* Risk distribution analysis
* Customer behavior insights

### 4. Model Management

* Model status and health
* Performance monitoring
* Configuration settings
* Model comparison

### 5. Alerts & Logs

* Real-time alerts
* System logs
* Risk notifications
* Alert history

### 6. Analyst Review

* Manual transaction review
* Feedback collection
* Review history
* Label management

### 7. Fraud Intelligence Network

* Multi-agent communication
* Real-time intelligence sharing
* Network configuration
* Agent status monitoring

### 8. OpenAI Playground

* **Code Generation**: Generate fraud detection code
* **Data Analysis**: AI-powered pattern analysis
* **Report Generation**: Automated reports
* **Model Explanation**: Explain predictions
* **Custom Prompts**: Interactive AI assistance

## 🤖 AI Chatbot Assistant

The dashboard includes an intelligent chatbot that supports multiple LLM providers:

* **Ollama** (Local): For privacy-focused deployments
* **OpenAI**: For advanced reasoning capabilities
* **HuggingFace**: For open-source model access
* **Rule-based**: Fallback responses for reliability

### Available OpenAI Models

| Model | Description | Best For |
| --- | --- | --- |
| **gpt-4o** | Latest and most capable | Complex tasks, best quality |
| **gpt-4o-mini** | Fast and efficient | Good balance of speed/capability |
| **gpt-4.1-mini** | New GPT-4.1 variant | Optimized for efficiency |
| **gpt-4.1-nano** | Smallest GPT-4.1 model | Fastest, most cost-effective |
| **gpt-3.5-turbo** | Reliable and cost-effective | Most tasks, good value |

## 🔧 Configuration

### Environment Variables

# Optional: For enhanced chatbot functionality  
OPENAI\_API\_KEY=your\_openai\_key  
HUGGINGFACE\_API\_KEY=your\_huggingface\_key

### Model Configuration

* Models are automatically loaded from models/bank\_fraud\_detector.pkl
* Risk thresholds are configurable in the dashboard
* Real-time settings can be adjusted in the sidebar

### OpenAI Integration

* **API Key**: Enter your OpenAI API key in the Playground tab
* **Model Selection**: Choose from 5 different models
* **Temperature Control**: Adjust creativity (0.0-2.0)
* **Token Limits**: Control response length (100-4000 tokens)

## 📈 Performance

* **Real-time Processing**: Sub-second transaction analysis
* **High Accuracy**: Multi-model ensemble approach
* **Scalable**: Designed for production banking environments
* **Low False Positives**: Optimized risk thresholds
* **AI Integration**: Seamless OpenAI API integration

## 🛠️ Technical Stack

* **Frontend**: Streamlit
* **Backend**: Python, FastAPI
* **ML Models**: Scikit-learn, XGBoost, LightGBM
* **Visualization**: Plotly, Matplotlib
* **LLM Integration**: OpenAI, HuggingFace, Ollama
* **Data Processing**: Pandas, NumPy
* **AI Services**: OpenAI GPT-4.1, GPT-4o models

## 🌐 Multi-Agent Intelligence Network

### Connected Agents

* **Jakarta Bank Consortium Agent**: BI-FAST fraud patterns
* **Singapore Regional Agent**: ASEAN fraud trends
* **Global AML Network Agent**: International money laundering

### Intelligence Sharing

* Real-time fraud pattern sharing
* Cross-border threat intelligence
* Automated alert distribution
* Network health monitoring

## 📝 License

This project is licensed under the MIT License - see the LICENSE file for details.

## 🤝 Contributing

1. Fork the repository
2. Create a feature branch
3. Make your changes
4. Add tests if applicable
5. Submit a pull request

## 📞 Support

For questions or support, please open an issue on GitHub or contact the development team.

**Built with ❤️ for secure financial transactions**