Literature Review

The importance of different commodities, like Gold, and the significance of forecasting their prices has always been important to all market players from governments, investors, and financial institutions to the everyday average consumer. Traditionally, economic models and statistical analysis have been applied to this end, however, these approaches have various limitations in capturing the complex non-linear dynamics of forecasting prices. This has led to the development of machine learning techniques. This literature review will review the current approaches in utilizing Machine Learning for Gold price forecasting, and identify key trends and remaining shortcomings.

Various Machine Learning algorithms have been applied to gold price forecasting, each with distinct advantages and drawbacks. Here is a review of some of the algorithms:

* **Support Vector Machines (SVMs):** This approach is effective in capturing non-linear relationships and handling high-dimensional data, but computationally expensive and requires careful feature engineering (Bhattacharjee et al., 2017).
* **Neural Networks (NNs):** This approach is highly flexible and capable of learning complex patterns but prone to over-fitting and necessitate large datasets for training. (Soni et al., 2023).
* **Fuzzy Inference Systems (FIS):** This approach is capable of incorporating expert knowledge and can handle linguistic variables, but interpretability can be challenging and data requirements might be high. (Iftikhar & Junejo, 2011).
* **Ensemble methods:** This approach is based on combining multiple models like SVMs, NNs, and FIS, and can leverage their individual strengths and achieve superior accuracy, often surpassing single algorithms approach. (Patalay et al., 2022).

There have been various other new approaches in utilizing Machine Learning in forecasting commodity prices. Here are some of these novel approaches:

* **Deep Learning**: Convolutional neural networks (CNNs) and recurrent neural networks (RNNs) are becoming popular as they can extract hidden features and model complex relationships from various data sources such as satellite images and financial news. (Wu et al., 2023).
* **Hybrid Approaches**: Integrating Machine Learning with domain knowledge through econometric models as well as incorporating sentiment analysis from social media data have further enhanced forecast accuracy. (Pan et al., 2022).

As commodity price forecasting continues to evolve, addressing the existing challenges and incorporating emerging trends has become crucial in developing reliable forecasting models. The key challenges that persist in applying machine learning are discussed as follows:

* **Data quality and availability**: Reliable and comprehensive data on various factors affecting gold prices, such as economic indicators, geopolitical events, and central bank policies, remains a challenge. Preprocessing data and handling missing values are crucial for effective model training.
* **Model interpretability and explainability:** Transparency and feature importance analysis are crucial for real-world applications. The black-box nature of some machine learning algorithms can hinder understanding how predictions are made, limiting trust and hindering implementation.
* **Incorporating real-time information:** Incorporating news events, weather patterns, and other dynamically changing factors can improve forecast accuracy but requires efficient data streaming and feature selection techniques.

In conclusion, traditional and current Machine Learning approaches have thus far provided great insight into forecasting commodity prices however the limitations in addressing the various shortcomings necessitate the need for the implementation of more agile and sophisticated Machine Learning approaches. Ultimately, harnessing the power of Machine Learning methods and developing robust transparent models that leverage diverse data sources, seamlessly incorporate domain knowledge, and adapt to the ever-changing global landscape could revolutionize gold price forecasting, allowing investors, governments, and financial institutions to navigate the volatile market with newfound confidence and precision.

Sources:

* Bhattacharjee, S., Tiwari, D., & Chatterjee, C. (2017). Prediction of gold price using support vector machines with radial basis function kernel. International Journal of Financial Studies, 5(4), 156.
* Soni, J., Kumar, V., & Sharma, T. (2023). Forecasting gold price using artificial neural networks: A comparative study. International Journal of Finance & Economics, 28(2), 389-404.
* Iftikhar, U. S., & Junejo, K. N. (2011). Predicting future gold rates using machine learning approach. International Journal of Business and Management, 6(10), 146.
* Patalay, S., & Yadav, J. P. (2022). Gold price prediction using machine learning model trees. Applied Mathematics and Computation, 446, 126196.
* Wu, J., Liu, Y., & Wang, F. (2023). Combining satellite images and LSTM networks for soybean price forecasting. Remote Sensing, 15(12), 2809.
* Pan, J., & Xu, X. (2022). A hybrid method for corn price forecasting based on domain knowledge and attention-based LSTM network. Information Sciences, 620, 85-102.