



Industrial Consultancy & Sponsored Research (IC&SR)

Method and Apparatus for performing outer link loop adaptation (OLLA) as multi-armed bandit (MAB)

IITM Technology Available for Licensing

PROBLEM STATEMENT

- It is noted that a **rate adaptation metric** reflects the **channel capacity** is computed at the User Equipment (UE), is quantized and fed back to the evolved Node B (eNB).
- Long Term Evolution (LTE) supports **4bit quantization** wherein the quantized feedback (Channel Quality Indicator (CQI)) is a number between 0 and 15. And Said **4bit CQI** value (Cu) is then mapped to a 5bit Modulation & Coding Scheme (MCS) (Mu), at the eNB, wherein the **MCS index** may **not be accurate** if the **CQI received** from the UE is **erroneous** including other **issues** related to quality of service, performing OLLA & etc.
- Hence, there is a need to address the issues.

INTELLECTUAL PROPERTY

IITM IDF Ref. 1353; IN Patent No:462317

TECHNOLOGY CATEGORY/MARKET

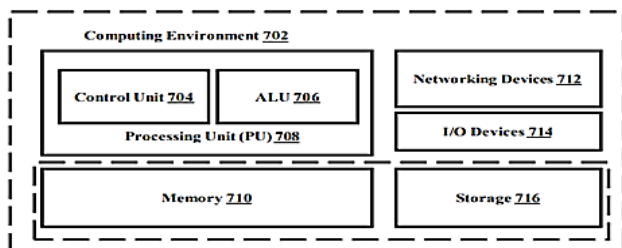
Technology: Performing outer link loop adaptation

Industry/Applications: Computer Technology, Wireless Communication, Computer Software, SMEs, Large Enterprises, Retail, BFSI etc.

Market: The global machine learning market is projected to grow at a **CAGR of 34.8%** during **2023-2030**.

TECHNOLOGY

- The present invention describes a **method and an apparatus for performing outer link loop adaptation (OLLA) as a Multi-Armed Bandit (MAB)**. (Refer Fig.1 (below) depicts the computing environment implementation of the proposed method)



- Said method comprises:
- In **First step** explains about the **associating** each of the **predefined Modulation and Coding Scheme (MCS)** indices to each of the arms of a Multi-Arm Bandit (MAB).
- The following step describes about the **determining** a **predefined MCS index** to meet a **predefined target Block Error Rate (BLER)**, wherein the predefined MCS index is determined based on a rate feedback value, and an offset value associated with each of the arms of the MAB.
- Yet Further step explains about the **selecting a first arm** of the MAB associated with the **determined predefined MCS index**.
- Still next step describes about the **determining** whether the **BLER**, based on a **cumulative Acknowledgement/Negative Acknowledgement (ACK/NACK) response** from a User Equipment (UE) for a Transport Block (TB).
- The **apparatus** also performs a few operations comprises of:
 - **selecting a second arm** of the **MAB**, associated with an increased offset value in comparison with the offset value associated with the first arm, in response to determining that the **BLER meets the predefined target BLER**.
 - **selecting a third arm** of the **MAB** in response to determining that the **BLER fails to meet** the predefined target BLER.

TRL (TECHNOLOGY READINESS LEVEL)

TRL-2/3, Proof of Concept ready

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Image

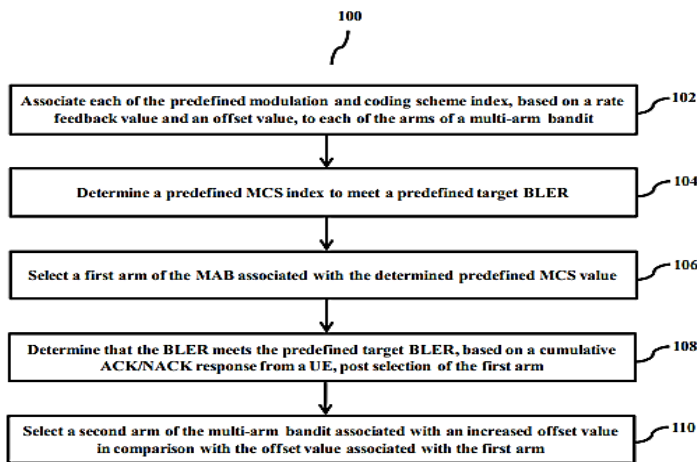


FIG. 1

Fig.2: Illustrates the flowchart depicting a method of performing outer link loop Adaptation (OLLA) by varying modulation and coding scheme (MCS) index as a multi-arm bandit (mab), wherein the second arm is selected;

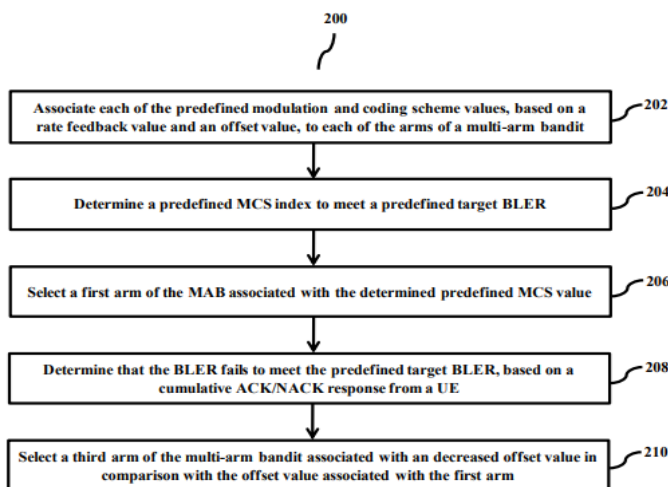


FIG. 2

FIG.3: Illustrates flowchart depicting the method of performing OLLA by varying the MCS index as a mab, a third arm is selected;

KEY FEATURES / VALUE PROPOSITION

❖ Technical Perspective:

- Associate each of the **predefined Modulation and Coding Scheme (MCS)** indices to each of the arms of a MAB.
- Determine a **predefined MCS index**, which is a combination of CQI value and an offset, to **meet a predefined target Block Error Rate (BLER)**.
- Select an arm of the MAB associated with the determined predefined MCS index to meet the **predefined target BLER**.
- Select the arm of the MAB based on a binary search mechanism, in which the **MCS index** is used as a **search metric** in the **binary search mechanism**.
- In the proposed method, **different offset values** constitute **arms** of the MAB.
- Offset values are used to **adjust** the MCS index for **achieving** a certain **target BLER**.

❖ Industrial Perspective:

- **Cost effective** method and apparatus.

Result

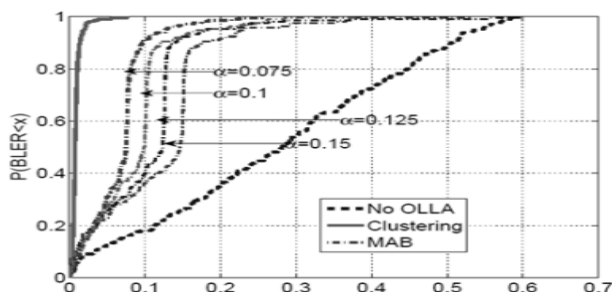


Fig.4A: Illustrates a graph depicting a comparison of the achieved BLER using the proposed method and existing methods;

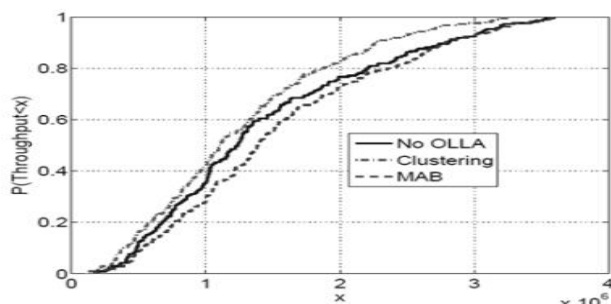


Fig. 4B: Illustrates a graph depicting a comparison of the throughput obtained;

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