

Emerging Technologies for Effective Teaching & Learning

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Overview of Learning Analytics

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Activity 1 – Think-Pair-Share

Consider a teacher who has been teaching the same subject at the same grade for several years. Each year, she has kept record of the students' marks in various exams.

Think: Write down one way in which she can use the data to improve students' learning.

Pair: Along with your neighbour, come up with one more way.

Share: Share answers with entire class.



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Activity 1 – Audience responses

Note them here:

Or on board:



Learning analytics

“Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs” - Wikipedia

Handbook of Learning Analytics – <https://solaresearch.org/hla-17/>



Key application – Adapting Instruction

Learner data is typically used to identify:

- Topics that are ‘difficult’ for learners
- Topics in which many learners have mis-conceptions
- Performance trends across groups over a period of time

In order to adapt instruction and provide:

- Remedial content or treatment
- Informed intervention for specific groups / topics
- Personalized learning



Stakeholders in LA

- Learner
- Teacher
- Researcher
- E-learning systems Developer
- Institute Head □ Ministry

Academic Analytics (Business Intelligence): LA applied to educational data at institute/regional/national level

- 'How to improve overall board exam performance in my school?'



Types of LA

Descriptive analytics – capture and represent data

- Example: Graph of performance over time

Diagnostic analytics – find patterns and correlations

- Example: Analyze why a student dropped out

Predictive analytics – predict future performance

- Example: Identify at-risk students

Prescriptive analytics – scaffold achievement of goal

- Example: Adapting instruction based on diagnosis and prediction

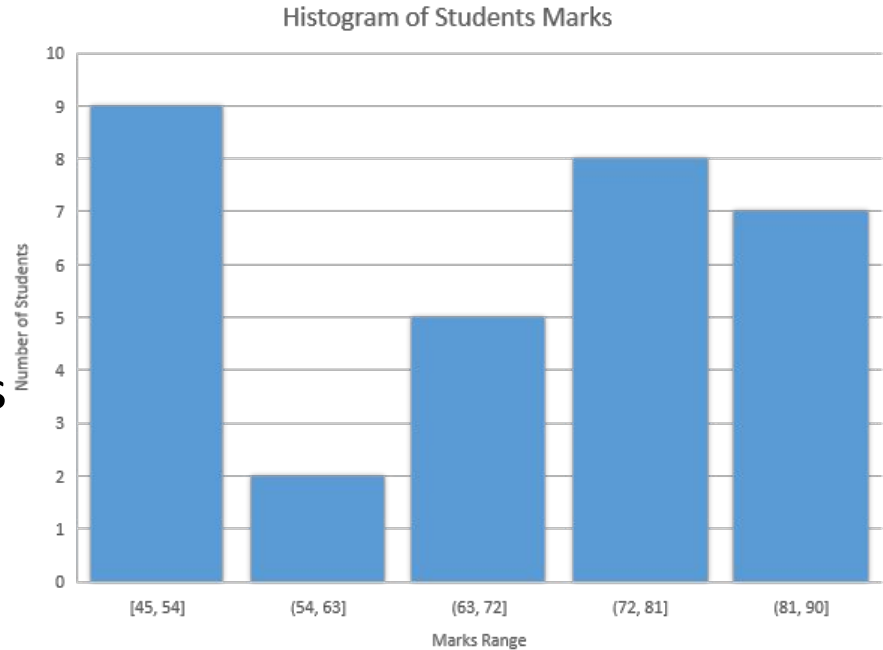
Example

Consider the data as shown:
the total marks and
attendance record of a
number of students

Student ID	Total Marks	Attendance
1	83	70
2	65	40
3	45	75
4	76	56
5	81	85
6	54	46
7	90	90
8	65	60
9	76	70
10	45	50
11	87	85
12	49	50

Descriptive Analytics

- If you want to check students' performance, you can use a Histogram
- Histogram indicates more students are in 45 to 54 range
- It also shows that 15 students out of 31 students scored more than 72 marks.

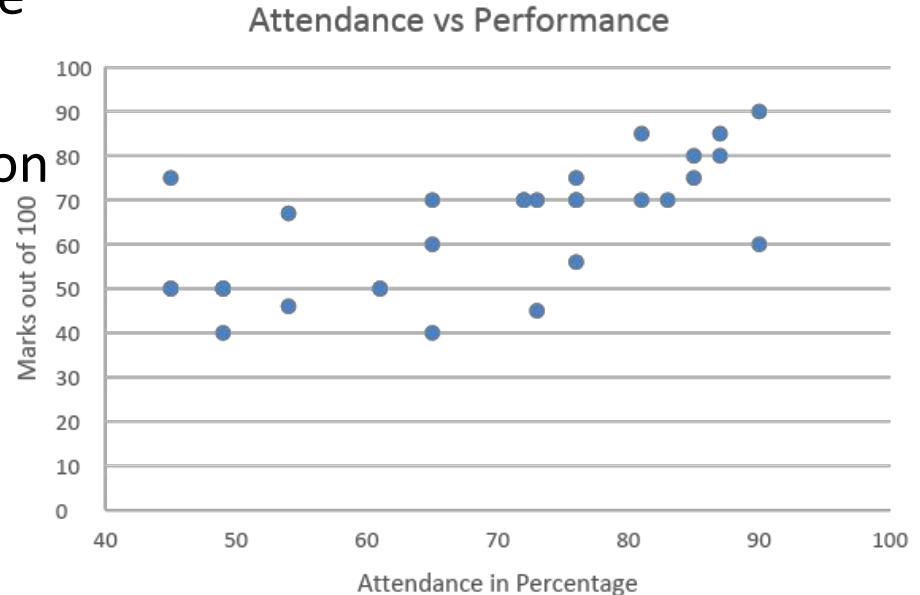


Diagnostic Analytics

- Suppose we want to check - why 11 students got less than 63 marks?
- We can collect more data - for example, attendance of the students.
- Plot Attendance vs Performance

There seems to be a linear relation

- Correlation coefficient 0.68
- Medium to strong correlation
- Pattern Mining, Process Mining



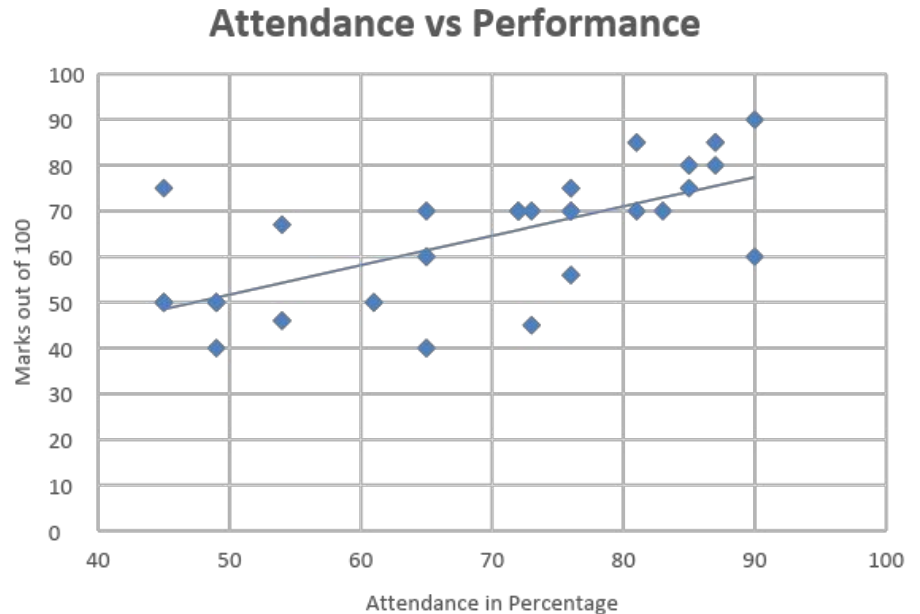
Predictive Analytics

- Prediction is done based on data from past events
- Model from past data and use it to predict for new data
- Linear Regression Model

$$Y = 0.64x + 19.6$$

- Can predict the performance of a student with 60% attendance

- Machine Learning Classifiers



Prescriptive Analytics

If we know a student is likely to fail in an exam,

- what changes/ new teaching learning strategy can we use to make the student to pass the exam (to achieve his learning goal)

Personalised and adaptive intelligent systems



Activity 2 – Examine in your own context

Along with your neighbour,

1. Revisit your answers for Activity 1. (strategies to improve learning)
2. What representation did you assume for the data items?
3. What correlations did you look for in your data?
4. What predictions did you make in order to come up with your strategy?
5. Reflect on the types of LA. – (see previous slides)
6. Map your answers above to the types of LA.
7. Share some answers with the class.



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Activity 2 – Audience responses

Note them here:

Or on board:



Scaling up LA – names of some techniques

As the volume of data (number of learners, types of items) increases, doing analytics by simply inspecting the data becomes difficult, automated methods and AI techniques are required for the analytics.

Some names of techniques:

- **Descriptive** analytics – Filtering, Dashboards
- **Diagnostic** analytics – Pattern Mining, Classifiers, Regression Analysis
- **Predictive** analytics – Naïve Bayes, SVM, Decision Trees
- **Prescriptive** analytics – Adaptation Algorithms



LA Tools – at a highly abstract level

Some names of Machine Learning tools for LA: RapidMiner, Weka,

...

Typical steps to be followed:

1. Input raw data (typically a spreadsheet)
2. Select features to be extracted for analysis (drop-down menu)
3. Configure the analytics technique to be run (drop-down menu)
4. Get output data (values, probabilities, graphs)
5. Interpret output

Human Intelligence is crucial for meaningful configuration of the techniques to be applied on the data, and interpreting the output,



LA – Multi-channel data and beyond

- Eye tracker – attention detection
- Facial expressions – emotion detection
- EEG signals analysis - feedback
- Microphone - capture environment and collaborative learning
- Kinect - detect posture and gesture
- Biological sensors – skin conductance
- Content analytics – video data, natural language processing

Why?

Towards constructing learner models and personalized / adaptive learning

Take-away



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Strong reasoning + meaningful use of analytics tools
trumps

Sophisticated analytics tools + mediocre reasoning



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Thank you

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