Research anomaly detection algorithms for time-series data and their application on data-analytics

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Abstract

Data is everything

Anomaly detection using data analysis is the key

Keywords: Machine Learning, Big-data, Anomaly detection

Contents

Chapter 1
1 Introduction

1.1 Bla bla

Communication and collective thinking are the key to the development of human civilization. This development is driven by data - "The new oil of this digital era". With the rise of media streaming services, there has been a huge surge in data traffic all over the world. It has also been estimated that by 2020 there will be 38.5 billion connected Internet of Things (IoT) devices [1, 2].Here is another reference for example [3]

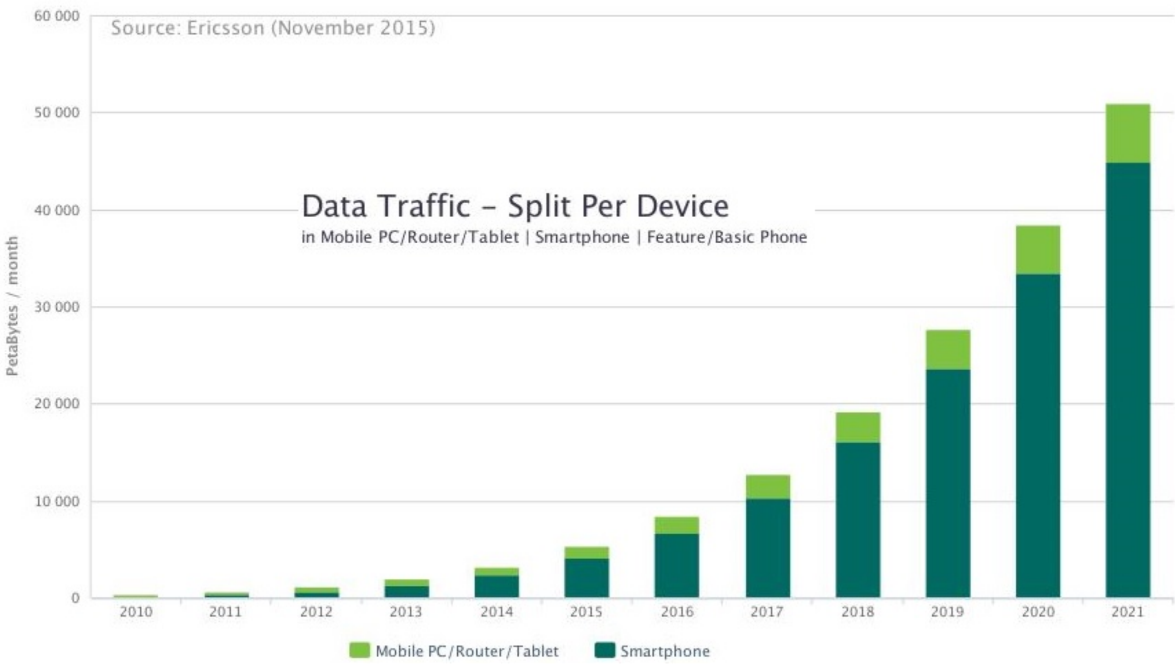

Figure 1.1: Data traffic growth forecast to 2021, as per Ericsson, generated using

1.2 Bla bla

1.3 Motivation for this thesis

1.4 Objectives of the thesis

Main objective: To design and fabricate a low power TPS based on MEMS tuning.

Sub objectives: The areas which will be addressed are:

- ☐ Evaluate feasibility of .
- ☐ Design a capable of tuning polarization in between the two fundamental waveguide modes.
- ☐ Demonstration of the with an extinction ratio of more than at least 10 dB for the two fundamental modes, in C and L bands.

1.5 Outline of this thesis

Chapter 2

2 Optical waveguide theory

2.1 Maxwell's equations

Chapter 3
State of the art

Before developing a for optical waveguides, the integrated passive and active Polarization Rotator (PR)s found in the recent literature and their underlying concepts are discussed in this chapter.

3.1 Polarization rotator (PR)

PRs help in rotating polarized fields from one to another in a controlled manner. Currently, both optical fiber and on-chip based PRs are available.

Chapter 4

4 Design and simulation

can be achieved in different ways, discussed in section. In this thesis, the goal is to achieve PR using MEMS for a broadband transmission, including the C and L bands. Moreover, the idea is to optimize the design to achieve high .

4.1 Approach

PR design can be approached in 2 ways. In a first approach, initially a passive PR can be designed by introducing asymmetry and a MEMS tunable waveguide is introduced which impedes polarization rotation by reintroducing symmetry in the effective waveguide. In a second approach, the technique is reversed i.e. the MEMS tunable waveguide is used to introduce asymmetry in the waveguide structure which rotates polarization. Without the MEMS structure the polarization is not rotated. In the design principle of the PR described here, the first approach is being followed.

Chapter 5
5 Implementation Algorithm

Chapter 6
6 Experiments

Chapter 7
Discussion

8 Chapter 8
Conclusions and Future work

8.1 Conclusions

Appendix A: Abbreviations

IoT Internet of Things. 1

PR Polarization Rotator. 4, 5

Appendix B: Graph generation script

```
%% Initialize variables.
filename = '/Users/Sandipan/Desktop/Test/mems.csv';
delimiter = ',';
startRow = 6;

%% Format string for each line of text:
% For more information, see the TEXTSCAN documentation.
formatSpec = '%f%f%q%f%[^\n\r]';
fileID = fopen(filename,'r');

%% Read columns of data according to format string.
dataArray = textscan(fileID, formatSpec, 'Delimiter',
    delimiter, 'EmptyValue' ,NaN,'HeaderLines' ,startRow-1, '
    ReturnOnError', false);
fclose(fileID);

%% Allocate imported array to column variable names
K=100;
w_RR = dataArray{:, 1};
w_slab = dataArray{:, 2};
%Slab width actual sizie scaling
w_slab = w_slab + 0.15;
w_RR(:) = round(w_RR(:)*K);
w_slab(:) = round(w_slab(:)*K);

lambda = abs(str2double(dataArray{:, 3}));
% Ratio of the polarization
rp = abs(real(log10(dataArray{:, 4})));
k = lambda>=1;
sums = accumarray( { w_RR(k), w_slab(k)}, rp(k),[],[],[],
    true );
[i,j,k] = find(sums);

%% Draw area chart
figure
hold on
```

```
matrix = [i/K j/K k];
tri = delaunay(matrix(:,1),matrix(:,2));
trisurf(tri,matrix(:,1),matrix(:,2),matrix(:,3))
shading faceted
grid on
hold off

%%Draw 5 max on graph
hold on
N = 5;
[sortedX, sortedInds] = sort(k(:),'ascend');
topN = sortedInds(1:N);
[m] = ind2sub(size(k), topN);

h = scatter3(i(m)/K,j(m)/K,k(m),'filled', 'MarkerFaceColor',
    'red');
h.SizeData = 100;

text(i(m)/K,j(m)/K,k(m),strcat('(',num2str(i(m)/K),',',
    num2str(j(m)/K),')'),'HorizontalAlignment','left', 'Color
    ', 'red', 'FontSize', 12)
hold off

%% Labels
xlabel('Rib width in \mum', 'FontSize',18,'FontWeight','bold
    ','Color','black')
ylabel('Base width in \mum', 'FontSize',18,'FontWeight','
    bold','Color','black')

zlabel_eq = '$$\sum_{mode}{abs\left(log \frac{E_{x_{mode}}}{
    E_{y_{mode}}}\right)}$$';
zlabel(strcat('Log ratio of E-field = ', zlabel_eq), '
    FontSize',22,'FontWeight','bold','Color','black','
    Interpreter','latex')

%% Clear temporary variables
clearvars filename delimiter startRow formatSpec fileID
    dataArray ans;
```

Bibliography

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[3] M. A. Green, J. Zhao, A. Wang, P. J. Reece, and M. Gal, "Efficient silicon light-emitting diodes," *Nature*, vol. 412, pp. 805–808, Aug. 2001.