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SCHOOL OF SCIENCES

DEPARTMENT OF INFORMATICS AND TELECOMMUNICATIONS

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ECONOMICS OF TELECOMMUNICATION NETWORKS AND INFORMATION
SYSTEMS**

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Onoma S. Epitheto

SUPERVISOR: First member, Rank Organization

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ΕΘΝΙΚΟ ΚΑΙ ΚΑΠΟΔΙΣΤΡΙΑΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

**ΣΧΟΛΗ ΘΕΤΙΚΩΝ ΕΠΙΣΤΗΜΩΝ
ΤΜΗΜΑ ΠΛΗΡΟΦΟΡΙΚΗΣ ΚΑΙ ΤΗΛΕΠΙΚΟΙΝΩΝΙΩΝ**

**ΔΙΑΤΜΗΜΑΤΙΚΟ ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ ΣΤΗ ΔΙΟΙΚΗΣΗ ΚΑΙ
ΟΙΚΟΝΟΜΙΚΗ ΤΩΝ ΤΗΛΕΠΙΚΟΙΝΩΝΙΑΚΩΝ ΔΙΚΤΥΩΝ ΚΑΙ ΠΛΗΡΟΦΟΡΙΑΚΩΝ
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ΠΤΥΧΙΑΚΗ ΕΡΓΑΣΙΑ

**Τίτλος πτυχιακής/διπλωματικής εργασίας / διδακτορικής
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Όνομα Σ. Επίθετο

ΕΠΙΒΛΕΠΩΝ ΚΑΘΗΓΗΤΗΣ: Πρώτο μέλος, Βαθμίδα Οργανισμός

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ABSTRACT

Tell me, O muse, of that ingenious hero who travelled far and wide after he had sacked the famous town of Troy. Many cities did he visit, and many were the nations with whose manners and customs he was acquainted; moreover he suffered much by sea while trying to save his own life and bring his men safely home; but do what he might he could not save his men, for they perished through their own sheer folly in eating the cattle of the Sun-god Hyperion; so the god prevented them from ever reaching home. Tell me, too, about all these things, O daughter of Jove, from whatsoever source you may know them.

So now all who escaped death in battle or by shipwreck had got safely home except Ulysses, and he, though he was longing to return to his wife and country, was detained by the goddess Calypso, who had got him into a large cave and wanted to marry him. But as years went by, there came a time when the gods settled that he should go back to Ithaca; even then, however, when he was among his own people, his troubles were not yet over; nevertheless all the gods had now begun to pity him except Neptune, who still persecuted him without ceasing and would not let him get home.

Now Neptune had gone off to the Ethiopians, who are at the world's end, and lie in two halves, the one looking West and the other East. He had gone there to accept a hecatomb of sheep and oxen, and was enjoying himself at his festival; but the other gods met in the house of Olympian Jove, and the sire of gods and men spoke first. At that moment he was thinking of Aegisthus, who had been killed by Agamemnon's son Orestes; so he said to the other gods:

See now, how men lay blame upon us gods for what is after all nothing but their own folly. Look at Aegisthus; he must needs make love to Agamemnon's wife unrighteously and then kill Agamemnon, though he knew it would be the death of him; for I sent Mercury to warn him not to do either of these things, inasmuch as Orestes would be sure to take his revenge when he grew up and wanted to return home. Mercury told him this in all good will but he would not listen, and now he has paid for everything in full.

Then Minerva said, Father, son of Saturn, King of kings, it served Aegisthus right, and so it would any one else who does as he did; but Aegisthus is neither here nor there; it is for Ulysses that my heart bleeds, when I think of his sufferings in that lonely sea-girt island, far away, poor man, from all his friends. It is an island covered with forest, in the very middle of the sea, and a goddess lives there, daughter of the magician Atlas, who looks after the bottom of the ocean, and carries the great columns that keep heaven and earth asunder. This daughter of Atlas has got hold of poor unhappy Ulysses, and keeps trying by every kind of blandishment to make him forget his home, so that he is tired of life, and thinks of nothing but how he may once more see the smoke of his own chimneys. You, sir, take no heed of this, and yet when Ulysses was before Troy did he not propitiate you with many a burnt sacrifice? Why then should you keep on being so angry with him?

And Jove said, My child, what are you talking about? How can I forget Ulysses than whom there is no more capable man on earth, nor more liberal in his offerings to the immortal gods that live in heaven? Bear in mind, however, that Neptune is still furious with Ulysses for having blinded an eye of Polyphemus king of the Cyclopes. Polyphemus is son to Neptune by the nymph Thoosa, daughter to the sea-king Phorcys; therefore though he will not kill Ulysses outright, he torments him by preventing him from getting home. Still, let us lay our heads together and see how we can help him to return; Neptune will then be pacified, for if we are all of a mind he can hardly stand out against us.

And Minerva said, Father, son of Saturn, King of kings, if, then, the gods now mean that Ulysses should get home, we should first send Mercury to the Ogygian island to tell Calypso that we have made up our minds and that he is to return. In the meantime I will go to Ithaca, to put heart into Ulysses' son Telemachus; I will embolden him to call the Achaeans in assembly, and speak out to the suitors of his mother Penelope, who persist in eating up any number of his sheep and oxen; I will also conduct him to Sparta and to Pylos, to see if he can hear anything about the return of his dear father- for this will make people speak well of him.

So saying she bound on her glittering golden sandals, imperishable, with which she can fly like the wind over land or sea; she grasped the redoubtable bronze-shod spear, so stout and sturdy and strong, wherewith she quells the ranks of heroes who have displeased her, and down she darted from the topmost summits of Olympus, whereon forthwith she was in Ithaca, at the gateway of Ulysses' house, disguised as a visitor, Mentis, chief of the Taphians, and she held a bronze spear in her hand. There she found the lordly suitors seated on hides of the oxen which they had killed and eaten, and playing draughts in front of the house. Men-servants and pages were bustling about to wait upon them, some mixing wine with water in the mixing-bowls, some cleaning down the tables with wet sponges and laying them out again, and some cutting up great quantities of meat.

[taken from <http://classics.mit.edu/Homer/odyssey.1.i.html>]

SUBJECT AREA: Internet of Things

KEYWORDS: Internet of Things, cloud computing, edge computing, serverless computing, big data, dimensionality reduction, PCA, SVD, Coresets

ΠΕΡΙΛΗΨΗ

Τον άντρα, Μούσα, τον πολύτροπο να μου ανιστορήσεις, που βρέθηκε ως τα πέρατα του κόσμου να γυρνά, αφού της Τροίας πάτησε το κάστρο το ιερό. Γνώρισε πολιτείες πολλές, έμαθε πολλών ανθρώπων τις βουλές, κι έζησε, καταμεσής στο πέλαγος, πάθη πολλά που τον σημάδεψαν, σηκώνοντας το βάρος για τη δική του τη ζωή και των συντρόφων του τον γυρισμό. Κι όμως δεν μπόρεσε, που τόσο επιθυμούσε, να σώσει τους συντρόφους. Γιατί εκείνοι χάθηκαν απ' τα δικά τους τα μεγάλα σφάλματα, νήπιοι και μωροί, που πήγαν κι έφαγαν τα βόδια του υπέρλαμπρου Ήλιου· κι αυτός τους άρπαξε του γυρισμού τη μέρα. Από όπου θες, θεά, ξεκίνα την αυτή την ιστορία, κόρη του Δία, και πες την και σ' εμάς.

Τότε λοιπόν οι άλλοι, όσοι ξέφυγαν τον άθλιον όλεθρο, όλοι τους ήσαν σπίτι τους, γλιτώνοντας κι απ' του πολέμου κι απ' της θάλασσας τη μάχη. Μόνο εκείνον, που τον παίδευε πόθος διπλός, του γυρισμού και της γυναίκας του, τον έκρυβε κοντά της μια νεράιδα, η Καλυψώ, θεά σεμνή κι αρχοντική, στις θολωτές σπηλιές της, γιατί τον ήθελε δικό της. Κι όταν, με του καιρού τ' αλλάγματα, ο χρόνος ήλθε που του ορίσαν οι θεοί να δει κι αυτός το σπίτι του, να φτάσει στην Ιθάκη, ούτε κι εκεί δεν έλειψαν οι αγώνες, κι ας ήταν πια με τους δικούς του. Ωστόσο οι θεοί τώρα τον συμπαθούσαν, όλοι εκτός του Ποσειδώνα· αυτός σφοδρό κρεμούσε τον θυμό του πάνω στον θεϊκό Οδυσσέα, προτού πατήσσει της πατρίδας του το χώμα.

Εκείνον όμως τον καιρό ο Ποσειδώνας είχε ταξιδέψει στους μακρινούς Αιθίοπες — οι Αιθίοπες στις δύο άκρες του κόσμου μοιρασμένοι· μισοί όπου ο ήλιος βασιλεύει, μισοί απ' όπου ο ήλιος ανατέλλει. Πήγε να πάρει μέρος στη θυσία, μιαν εκατόμβη με ταύρους και κριάρια, και τώρα ευφραίνονταν στις τάβλες καθισμένοι. Τότε συνάχτηκαν οι υπόλοιποι θεοί στου ολύμπιου Δία το παλάτι, όπου εκείνος πρώτος πήρε τον λόγο, πατέρας ανθρώπων και θεών. Στον νου του φέρνοντας, θυμήθηκε τον φημισμένο Αίγισθο, που τον θανάτωσε ο ξακουστός Ορέστης, γιος του Αγαμέμνονα· αυτόν θυμήθηκε μιλώντας ο θεός στους αθανάτους:

Αλίμονο, είναι αλήθεια ν' απορείς που θέλουν οι θνητοί να ρίχνουν στους θεούς τα βάρη τους· έρχεται λένε το κακό από μας — κι όμως οι ίδιοι, κι από φταίξιμο δικό τους, πάσχουν και βασανίζονται, και πάνω απ' το γραφτό τους. Έτσι και τώρα ο Αίγισθος, την ορισμένη μοίρα παραβαίνοντας, πήγε να σμίξει με τη νόμιμη γυναίκα ενός Ατρείδη, κι αυτόν τον σκότωσε στου γυρισμού την ώρα, γνωρίζοντας τι τιμωρία σκληρή τον περιμένει· αφού εμείς του στείλαμε τον άγρυπνον αργοφονιά Ερμή με μήνυμα, μήτε εκείνον να σκοτώσει μήτε και τη γυναίκα του να μπλέξει σε παράνομο κρεβάτι· αλλιώς θα πέσει στο κεφάλι του η εκδίκηση του γιου για τον πατέρα, όταν ο Ορέστης, παλληκάρι πια, θελήσει να γυρίσει στην πατρίδα. Αυτά, με τόση φρόνηση ο Ερμής μιλώντας, του μηνούσε, κι όμως τον νου του Αιγίσθου δεν κατόρθωσε ν' αλλάξει. Τώρα, ακέριο και μεμιάς, το άνομο κρίμα του ξεπλήρωσε.

Αμέσως ανταπάντησε, τα μάτια λάμποντας, η Αθηνά: Πατέρα μας των αθανάτων, Κρονίδη, των δυνατών ο παντοδύναμος, καλά κι όπως του ταίριαζε, εκείνος αφανίστηκε και

πάει — την ίδια μοίρα να 'χει κι όποιος ανάλογα κριματιστεί. Εμένα όμως για τον Οδυσσέα φλέγεται η καρδιά μου· γενναίος αλλά δύσμοιρος, να βασανίζεται με τόσα πάθη, απ' τους δικούς του χωρισμένος, σ' ένα περίβρεχτο νησί, στον ομφαλό, όπως λένε, της θαλάσσης. Νησί κατάφυτο με δέντρα, και μια θεά το κατοικεί στα δώματά της· η θυγατέρα του Άτλαντα, που η γνώμη του γυρίζει μόνο στο κακό — ξέρει καλά αυτός των θαλασσών τα βάθη, και πάνω του σηκώνει ψηλές κολόνες, να κρατούν τον ουρανό χώρια απ' τη γη. Η θυγατέρα του λοιπόν τον Οδυσσέα κατακρατεί, δύστυχο κι οδυρόμενο· λόγια γλυκά προφέροντας και μαλακά σαν χάδια, τον θέλγει ακατάπαυστα, για να ξεχάσει την Ιθάκη. Εκείνος όμως, βυθισμένος στον καημό του, να δει καπνό της πατρικής του γης ψηλά να ανηφορίζει, απελπισμένος εύχεται τον θάνατο. Εσένα ωστόσο, Δία ολύμπιε, ως πότε αλύγιστη θα μείνει η βουλή σου; Ο Οδυσσέας δεν ήταν που θυσίες σου πρόσφερε στην ευρύχωρη Τροία, πλάι στ' αργίτικα καράβια; Πώς και γιατί τόσοσ θυμός γι' αυτόν, ω Δία;

ΘΕΜΑΤΙΚΗ ΠΕΡΙΟΧΗ: Διαδίκτυο των Πραγμάτων

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: Διαδίκτυο των Πραγμάτων, υπολογιστική νέφους, υπολογιστική παρυφής, υπολογιστική χωρίς διακομιστή, δεδομένα μεγάλης κλίμακας, μείωση διαστάσεων, PCA, SVD, Coresets

To my dear person.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor [Rank] [Name], his guidance and valuable contributions were crucial to complete this work. I am also grateful to my family for all their love and support throughout this journey.

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PREFACE

This master Thesis was carried out in the [interdepartmental] postgraduate studies program of "[post-graduate program name]" of the Department of Informatics and Telecommunications of the National and Kapodistrian University of Athens. The goal of my research is to study

I would like at this point to express my warmest gratitude to my supervisor, [Rank] [Name], for guidance and valuable contributions.

1. INTRODUCTION

This is a sample citation [1] and another one [1, 2].

Tell me, O muse, of that ingenious hero who travelled far and wide after he had sacked the famous town of Troy. Many cities did he visit, and many were the nations with whose manners and customs he was acquainted; moreover he suffered much by sea while trying to save his own life and bring his men safely home; but do what he might he could not save his men, for they perished through their own sheer folly in eating the cattle of the Sun-god Hyperion; so the god prevented them from ever reaching home. Tell me, too, about all these things, O daughter of Jove, from whatsoever source you may know them.

So now all who escaped death in battle or by shipwreck had got safely home except Ulysses, and he, though he was longing to return to his wife and country, was detained by the goddess Calypso, who had got him into a large cave and wanted to marry him. But as years went by, there came a time when the gods settled that he should go back to Ithaca; even then, however, when he was among his own people, his troubles were not yet over; nevertheless all the gods had now begun to pity him except Neptune, who still persecuted him without ceasing and would not let him get home.

Now Neptune had gone off to the Ethiopians, who are at the world's end, and lie in two halves, the one looking West and the other East. He had gone there to accept a hecatomb of sheep and oxen, and was enjoying himself at his festival; but the other gods met in the house of Olympian Jove, and the sire of gods and men spoke first. At that moment he was thinking of Aegisthus, who had been killed by Agamemnon's son Orestes; so he said to the other gods:

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Then Minerva said, Father, son of Saturn, King of kings, it served Aegisthus right, and so it would any one else who does as he did; but Aegisthus is neither here nor there; it is for Ulysses that my heart bleeds, when I think of his sufferings in that lonely sea-girt island, far away, poor man, from all his friends. It is an island covered with forest, in the very middle of the sea, and a goddess lives there, daughter of the magician Atlas, who looks after the bottom of the ocean, and carries the great columns that keep heaven and earth asunder. This daughter of Atlas has got hold of poor unhappy Ulysses, and keeps trying by every kind of blandishment to make him forget his home, so that he is tired of life, and thinks of nothing but how he may once more see the smoke of his own chimneys. You, sir, take no heed of this, and yet when Ulysses was before Troy did he not propitiate you with many a burnt sacrifice? Why then should you keep on being so angry with him?

[taken from <http://classics.mit.edu/Homer/odyssey.1.i.html>]

2. BACKGROUND AND RELATED WORK

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3. ANOTHER CHAPTER

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4. CONCLUSIONS AND FUTURE WORK

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So now all who escaped death in battle or by shipwreck had got safely home except Ulysses, and he, though he was longing to return to his wife and country, was detained by the goddess Calypso, who had got him into a large cave and wanted to marry him. But as years went by, there came a time when the gods settled that he should go back to Ithaca; even then, however, when he was among his own people, his troubles were not yet over; nevertheless all the gods had now begun to pity him except Neptune, who still persecuted him without ceasing and would not let him get home.

Now Neptune had gone off to the Ethiopians, who are at the world's end, and lie in two halves, the one looking West and the other East. He had gone there to accept a hecatomb of sheep and oxen, and was enjoying himself at his festival; but the other gods met in the house of Olympian Jove, and the sire of gods and men spoke first. At that moment he was thinking of Aegisthus, who had been killed by Agamemnon's son Orestes; so he said to the other gods:

See now, how men lay blame upon us gods for what is after all nothing but their own folly. Look at Aegisthus; he must needs make love to Agamemnon's wife unrighteously and then kill Agamemnon, though he knew it would be the death of him; for I sent Mercury to warn him not to do either of these things, inasmuch as Orestes would be sure to take his revenge when he grew up and wanted to return home. Mercury told him this in all good will but he would not listen, and now he has paid for everything in full.

Then Minerva said, Father, son of Saturn, King of kings, it served Aegisthus right, and so it would any one else who does as he did; but Aegisthus is neither here nor there; it is for Ulysses that my heart bleeds, when I think of his sufferings in that lonely sea-girt island, far away, poor man, from all his friends. It is an island covered with forest, in the very middle of the sea, and a goddess lives there, daughter of the magician Atlas, who looks after the bottom of the ocean, and carries the great columns that keep heaven and earth asunder. This daughter of Atlas has got hold of poor unhappy Ulysses, and keeps trying by every kind of blandishment to make him forget his home, so that he is tired of life, and thinks of nothing but how he may once more see the smoke of his own chimneys. You, sir, take no heed of this, and yet when Ulysses was before Troy did he not propitiate you with many a burnt sacrifice? Why then should you keep on being so angry with him?

[taken from <http://classics.mit.edu/Homer/odyssey.1.i.html>]

ABBREVIATIONS - ACRONYMS

AI	Artificial Intelligence
ANN	Artificial Neural Network
GAN	Generative Adversarial Network
GRU	Gated Recurrent Units
LSTM	Long Short-Term Memory
NN	Neural Network
ReLU	Rectified Linear Unit
RNN	Recurrent Neural Network
SVM	Support Vector Machine

APPENDIX A. FIRST APPENDIX

APPENDIX B. SECOND APPENDIX

APPENDIX C. THIRD APPENDIX

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